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March 1974

# 73 magazine
for radio amateurs

FCC Commissioner Wiley examines HT's . . . details inside.

Repeater Councils Get FCC Hearing

Major Rules Change Announced !!!

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W2ODC

W2EUP

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K4ROZ

K6VGP

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WA0IDQ

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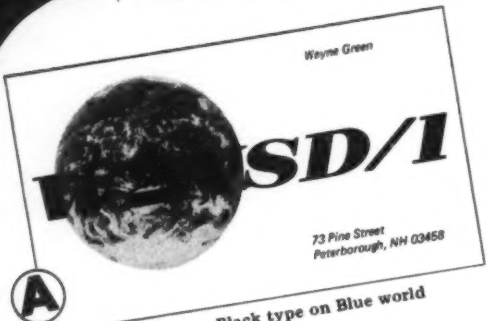

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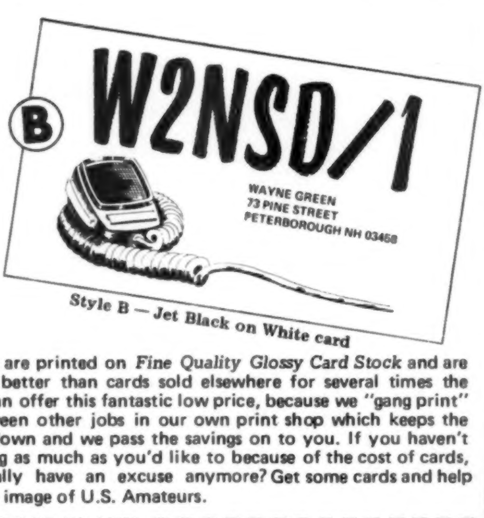

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# 73 magazine
for radio amateurs

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COVER: Commissioner Wiley, who took a particular interest in the problems of amateur radio. . .and the ad hoc committee representing repeater councils from coast to coast which testified before the FCC Hearing on January 14th. The hearing was organized and moderated by Wayne Green W2NSD/1.

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. . .de W2NSD/1

EDITORIAL BY WAYNE GREEN

FCC HEARS AMATEUR PLEA!

The reaction of amateurs and repeater groups to the new rules for repeaters released in 1972 under the heading of Docket 18803 was so vigorous that it eventually resulted in a precedent shattering hearing before the full Commission!

When Docket 18803 was originally proposed in 1970 the amateur reaction was immediate and vigorous. The then Chief of the Amateur Division decided that the proposals were unworkable and that a completely new docket would have to be devised, one which would be more in line with the FM scene as it was at that time. The proposal for repeater rules had been kicking around for years and was hopelessly out of date in 1970.

The old Chief of the Amateur Division retired and was replaced by Walker and most repeater groups expected the new shuffle to materialize on the proposed rules. Consternation was the order of the day when Docket 18803 suddenly was enacted. The repeater groups could hardly believe what they saw, the rules were so incredible and so unrealistic, "Assinine," was the comment of ARRL spokesman McCoy, the League's FM "expert."

The first reaction was a flood of petitions and letters, all asking for mercy. The second blow was when the Commission announced that every petition, without exception, had been summarily denied. It was reliably reported that this was done by the Commission at the request of Walker to try and save him the embarassment of admitting that his work on the rules had been faulty.

Walker went even further at Rochester where he told the amateurs there in a speech that any further petitions for Docket 18803 rule changes would be thrown out since that matter had already been completely considered. What could amateurs do next?

The alarm of the repeater groups turned out to be valid. Amateurs have always prided themselves on their ability to be self-policing and on being the best behaved service under the FCC. Suddenly several responsible groups of amateurs decided that the rules were so unfair and inequitable that they would ignore those which were most odious and which were senseless to them.

The FCC bogged down almost totally under the burden of repeater applications so that extension after extension had to be granted to the impractical deadlines set in the docket. The new rules were so complicated and demanding that, even with all the guidance 73 and QST could provide, over 90% of the applications were rejected. With rule and application interpretations changing every few days, and with the embarassment of this debacle becoming more apparent daily, less and less information became available from the Commission to the magazines.

CONGRESS ALERTED TAPES AVAILABLE

With all approaches to the FCC seemingly closed down, amateurs turned to Congress for help. Dozens of amateurs sent in for copies of the 73 letter to Congress which explained about the value of amateur radio, what repeaters are, and the difficulty with the repeater regulations. These were sent, together with covering letters, to their Congressmen and Senators. The Commission, being sensitive to such pressures, responded favorably.

A special hearing was set up for January 14th for the Commissioners to be presented with a report on the repeater regulations and the reasons why they are restrictive and should be changed. A synopsis of the material to be covered during the hearing was prepared by Wayne Green and sent, along with copies of over 3000 signatures requesting a reopening of Docket 18803, to the Commissioners.

The hearing before the Commissioners on the need for changing the repeater regulations is a first. Never before has an amateur radio group been able to appeal to the Commission en banc for changes in the rules. Of course, never before has there been such a unanimity of purpose among amateurs that rules needed changing.

Representatives of repeater councils of California, Colorado, Wyoming, Michigan, Georgia, Western New York, Greater New York City, Missouri, Eastern New York and New England attended and testified. A tape was made of the hearing and that is available from 73 Magazine, Peterborough NH 03458 on a 90-minute cassette for $5. The tape came out quite well. It makes for interesting listening. The 90-minutes is a little long for a single club meeting, but it might be split in half for two meetings. It's a little long for a few of the repeater timers, but that is surmountable.

The Commissioners not only were interested in the proceeding, but responded with good questions and indicated a sympathetic attitude. They asked that the hearing be followed up with new petitions for rule changes. This was the result that everyone had hoped for.

FREEDOM WAS THE GIST

The main thrust of the testimony before the Commission was that amateurs should be free to invent, to experiment, and to be self-regulating. The example of the repeater councils was given to demonstrate that amateurs are able to set up their own sub-bands and even coordinate frequencies for channelized operation.

Good cases were made for relaxing the monitoring restrictions, the subband frequency restrictions, the crossbanding restrictions, linking of repeater restrictions, ten meter repeater restrictions, and such. None of these restrictions are needed and all tend to inhibit amateur ingenuity.

If any serious results had resulted from the freedom that repeater groups had before Docket 18803, then some of the new rules might make more sense, but the fact was that difficulties were individual and isolated, being by far the exception to the normal. A sense of perspective seemed to be missing. Just because one New York repeater had a CBer raising hell with it for a few days and a Chicago repeater had a musician giving the boys music until he was routed out is hardly enough reason for making over a thousand repeaters monitor 24 hours a day to prevent a repetition of these outrages.

One result of over-reacting like that will be that amateurs will shut the FCC off from communication and not let them know about little problems in fear of future over-reaction. It is possible that a Midcars complaint to the FCC about interference to their net by unidentified stations could trigger off a rule that every transmitter in the amateur service be equipped with a builtin automatic identifier, like a repeater, thus killing the flea with a sledgehammer.

Marty WB6MFA, Dick K6VGP, Mike WB2EIL, Bert WA0IDQ, Marshall WB0HWQ.

VISUAL AID

Bert Reuler undertook to testify on the restrictiveness of the rules regarding portable repeaters and his exhibit was a complete repeater in an attache case! It was self-powered, with duplexer, and had a little antenna that stuck out the side of the case.

The main theme of the testimony regarding emergency service by amateurs was that the present Commission concept of amateurs setting up a system for a specific emergency is unworkable. The *only* reliable emergency system is one that is in constant use. Anyone who has worked with repeaters knows that repeater dependability means work, work and more work.

It is probably true that the present rules, which do permit the testing of emergency repeaters, could be interpreted as permitting a test of, say, ten years. One problem with this is that eventually some hard nosed amateur will come along and demand that the FCC define their terms and louse it up.

The same approach could be used to set up multiple repeater links. The rule (97.89-3c) does allow "brief periods to conduct emergency preparedness tests." A test of much less than several years on any emergency system would very unlikely be inconclusive, and would certainly be considered "brief" by most repeater groups.

COMMISSIONER WILEY WITH HT

The highly modified HT-100 of Dick McKay, complete with miniature touchtone pad, brought an enthusiastic response from FCC Commissioner Wiley at the recent hearing. The conversion of the unit was described in the November issue of 73.

It now appears that if the repeater councils are able to get together and convince the Commission that they have matters under control that it will be possible for many, if not all, of the restrictions on repeaters to be lifted.

HAM DEALER TESTIFIES

One of the council representatives at the recent hearing before the FCC in Washington was Henry Ruh WB8HEE of Communications Unlimited. You've probably seen Henry's ads for video tape equipment in 73 Magazine. He's been doing a first rate job of selling VTR equipment to radio amateurs. Never before has equipment been available at such reasonable prices, so few amateurs have had the opportunity to get involved with VTRs. This equipment, available at bargain prices, has been most helpful to the amateur television experimenters.

Henry represented the Michigan Repeater Council at the FCC hearing and helped put over the case that amateurs have been over-regulated.

COMMISSION RESPONSIVE

At the conclusion of the presentation the Commissioners indicated that they were interested in new petitions for changing the repeater rules. Marty Barrack WB6MFA, was chosen by the group to prepare the petitions to eliminate the restrictions. The group had, during the planning sessions preparatory to the hearing, gone over the rules and agreed upon the desired changes.

The group met again in the afternoon of the hearing day with Charley Higginbotham, the Chief of the Safety and Special Services, and the immediate superior to Walker. This turned out to be a very productive meeting. More meetings like that could have no other result than more realistic regulations for amateur radio. But how can you get representatives of amateur groups from all over the country to Washington for such meetings?

The need is for well informed amateurs to be available to work with the FCC on new rules – to answer their questions – to provide them with the information on how things really are in practice and to judge the effects of proposed rule changes. One proposal that seemed to have merit was some sort of periodic amateur conference where representatives of amateur clubs would meet and propose regulation changes to meet currrent amateur needs. This would be something like Congress, with committees reporting to the main body for the final votes. The ITU works like this. Such a plan would give radio clubs more of a stake in the running of amateur radio since they would be advising and funding their delegate to the conference.

LIBERTY LOBBY

After the hearing at the FCC I popped over to see the Liberty Lobby in Southeast Washington. This is a small and vigorous lobby which is fighting the government in many areas. Their stand on tax revolt interested me in particular. They have been distributing the Larson book, Tax Revolt USA, which is a corker ($5 from Liberty Lobby, 300 Independence Ave. SE, Washington 20003).

Liberty Lobby produces tape programs from a small studio in the cellar and pamphlets, newsletters and such from a few crowded offices upstairs. They keep close track of what is going on and get the information out to counter any trends which they feel are at odds with their philosophy.

They have a nice ham station set up there too and they use this to check into the Liberty Lobby net on Saturdays at 1:15 PM EDT on 14320 kHz.

Amateur radio doesn't need anything quite as big as the Liberty Lobby, but they do need an office in Washington with a staff of two or three dedicated amateurs to keep track of what is happening and get the word out. News of approaching FCC

Continued on page 102

Tom DiBiase WB8KZD
708 6th Avenue
Steubenville OH 43952

Mar 9-11	**Virginia QSO Party**
Mar 9-10	**Worldwide VHF Activity**
Apr 12-14	**Novice Contest**
Apr 12-15	**County Hunters SSB Contest**
Apr 20-22	**ZERO District QSO Party**
May 11-13	**Georgia QSO Party**
May 18-20	**Connecticut QSO Party**

Virginia QSO Party

From 1800Z March 9 to 0200Z March 11, 1974. Phone & CW are part of the same contest. Stations may be worked once per band/mode. Virginia may work Virginia. Exchange signal report plus QSO number & QTH (Virginia county, state, province, or country). Score 1 pt. per QSO, Non-Virginia multiply by total Virginia counties, Virginia stations multiply by total QTHs worked (see QTH above). Frequencies: 3560, 7060, 14060, 21060, 28060 CW; 3930, 7230, 14285, 21375, 28575 SSB. Appropriate awards. LOGS — Indicate each new multiplier worked. Summary sheet and check list requested. Mail so as to be received no later than April 15, 1974. Send to Don Miles W4IML, 9801 Lomond Dr., Manassas VA 22110. SASE for results.

Worldwide VHF Activity

From 1500 local time March 9 to 2200 local time March 10. Bands are 6m, 2m, 1¼m. Exchange call letters, county, state and short ragchew. Each band will be scored separately. Stations may be worked once per band. To score for a given band, multiply total QSOs by total counties worked multiplied by total states worked. Show club call sign on log if club is working toward aggregate award. Two forms of competition — individual and aggregate. Many awards and certificates. No restrictions on using repeaters or any modes as long as legal. Send logs and SASE for awards by April 15, 1974 to WA3NUL, P. O. Box 1062, Hagerstown MD 21740.

Novice Contest

The International Novice Amateur Radio Association will hold its 1974 Novice QSO Party from Friday, April 12, 1800 GMT to Sunday, April 14, 1974, 0600 GMT. Group: any class amateur to work novice operators throughout the world. Exchange RST and handle. Work each station only once. Multiply total number of QSOs by the number of different prefixes worked. Appropriate awards for novice and non-novice operators. Send logs to Andi Anderson WB9FGM, RR #3, Box 85-26, Belvidere IL 61008 by May 1, 1974.

Connecticut QSO Party

2100 GMT May 18, to 0200 GMT May 20. Both CW and Phone permitted. Exchange QSO number, RST, ARRL Section for out of state stations, Connecticut County for Connecticut stations. Stations may be worked once on each band and also in each mode. Stations outside Connecticut multiply total number of QSOs by the number of Connecticut counties worked (maximum of 8). Connecticut stations multiply number of QSOs by number of ARRL sections or provinces. Suggested Frequencies: CW — 3540, 7040, 14040, 21040, 28040; Phone — 3925, 7250, 14300, 21375, 285480; Novice — 3725, 7125, 21125, 28125. Appropriate awards. A special WACC (Worked All Connecticut Counties) certificate will be awarded to each station, in or out of state, who works a station in each of the 8 Connecticut counties. Logs must be postmarked by June 20 and sent to: Candlewood Amateur Radio Association, c/o Donald Crosby W1EJM, 10 Royal Road, Danbury CN 06810. Send large SASE for results.

Results: 1973 Vermont QSO Party —

Top four out-of-state: K4YXJ, WA2PW/0, WA6PGB.

Top four Vermont: W1AYK, WA1KPJ, WA1GKS, W1FRT.

Results: 1973 Washington QSO Party —

Top four out-of-state: W5TWI, WA9GAM, K6WT, WB5IQG. (K6WT squeezed by WB5IQG by only 42 points to take third spot).

Top four Washington: W5QQQ/7, WA7RPI, K7NCG, K7UWT.

Results: 1973 CW County Hunters Contest —

High Score Fixed: WB4OGW.
High Score Portable: WA0TKJ/0.
Mobile: K0QIX/M.

Results: 1973 Georgia QSO Party —

Top seven out-of-state: K4VFY, WA0TKJ, K2VGR, W6PAA, K3HXS, WB4LHK, WA3PWL/0. (Closest race was for fifth with K3HXS topping WB4LHK by 30 points.)

Top seven Georgia: WB4UFW, K4BAI, K4TBN, W4YDN/4, W5YOX/M, K4FRM, WB4DBO.

(WB4UFW ended up with the amazing score of 132,770 points. This score topped that of K4BAI, (second place) by a margin of 63,218 points; however, there were 5 operators at WB4UFW, while K4BAI was all by himself.)

Results: 1973 Delaware QSO Party —

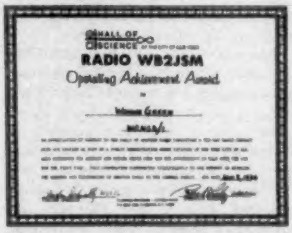
Top three out-of-state: W3GWA, WA6PGS, W9STW.

Top three Delaware: K3YHR, WA3PCC, K3KAJ.

DIAL TWISTERS CERTIFICATTE

The Spokane Dial Twisters ARC will have a "Dial Twisters Weekend" on March 9-10, to promote ham radio and help other hams acquire the prestigious and famous "Dial Twisters Certificate." Rules, times, dates and all that other good stuff can be had by dropping a line to: Tony Kjeldsen K7VNT, 223 East Bridgeport, Spokane WA 99207.

Hall of Science Award



HALL OF SCIENCE

RADIO WB2JSM

Operating Achievement Award

The Hall of Science of New York, operates Amateur Radio Station WB2JSM as a public exhibit where visitors can see and participate in a station actually on the air.

An attractive, free, award certificate will be mailed to those amateur stations who work WB2JSM. WB2JSM is on the air daily except Mondays beginning at 10:00 AM EDT. On weekdays it is in operation until 2:00 PM, and in operation on Saturdays and Sundays until 5:00 PM. Frequencies worked are usually in the General portion of the bands with 20m and 15m the most used. All stations having previously participated can obtain the certificate on request noting QSO date to Box 1032, Flushing NY 11352.

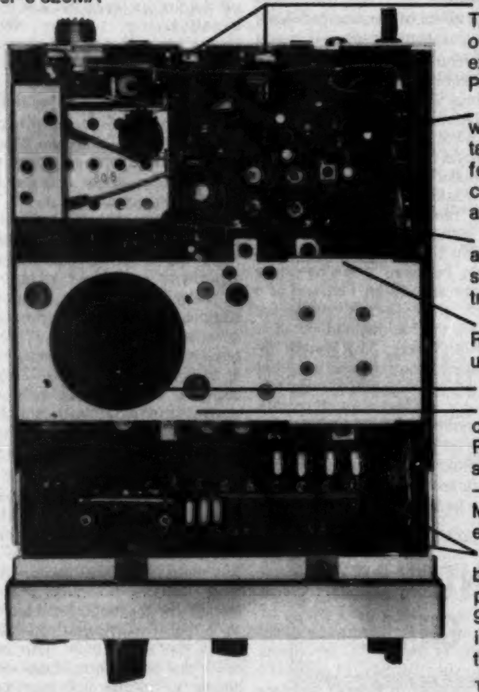
Winnipeg Centennial Award

Mayor Stephen Juba and the Winnipeg Amateur Radio Club are pleased to offer *The City of Winnipeg Centennial Award*, in commemoration of the centennial of the city of Winnipeg, Canada in 1974. The certificate is in full color showing the Centennial symbol and is signed by Mayor Juba. This award replaces the *Worked All Winnipeg Award* for 1974. For operating requirements and further information contact: Winnipeg Amateur Radio Club Award, P.O. Box 352, Winnipeg, Manitoba, Canada.

WB8KZD

ANATOMY OF A GREAT 2-METER RADIO

sr-c 826MA



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FCC NEWS

Amendment of Part 97 regarding the showings required with applications for repeater stations.

Adopted: January 10, 1974
Released: January 11, 1974

By the Commission

1. The purpose of this Order is to amend the rules for the Amateur Radio Service to change the requirement that certain technical data related to a repeater station be filed with the application for that station. The data now only need be entered in the station log. It will no longer be necessary to include the data with the repeater station application.

2. It is evident to us, from the experience gained in processing almost 500 applications for amateur repeater stations, amateurs have developed the knowledge and capability to properly determine the parameters of antenna height above average terrain and effective radiated power, in accordance with our rules. Therefore, data on these parameters are changed from application requirements in Section 97.41(f), to logging requirements in Section 97.111(f). This revised procedure will benefit applicants, since they will no longer need to include data with their applications. It will also benefit repeater station licensees, since they must no longer submit proposed changes to the Commission, before making modifications to their stations which would change these parameters. It will benefit the Commission, since it will not be necessary for us to review and approve data. Therefore, these amendments offer mutual benefits to amateurs and to the Commission.

3. In Section 97.108(a)(4), the word "automatically" is deleted from the requirement for provisions to limit the transmissions from a remotely controlled station in the event of a malfunction in the control link. The purpose of the requirement is to have a backup method of terminating transmission. It is immaterial whether the method is automatic or manual, and many systems have been licensed that use backup shutdown methods that are more manual than they are automatic.

4. The words "as installed," which were contained in the deleted Section 97.41(f)(6), are not included in the new counterpart Section 97.111(f)(7). We have learned from our processing experience, it is overly difficult for most amateurs to determine radiation patterns of an antenna as installed. We feel this requirement can be deleted without seriously compromising the overall results.

5. The net effect of these amendments will be a reduction in the initial showings required for all repeater station applications, and the elimination of showings with applications for repeater stations not proposed for remote control or involving auxiliary link stations. Licensees will now be able to make modifications to their repeater stations, except for changes involving remote control or link aspects, without the need for prior Commission approval. Our processing is making headway licensing those applications already on file, and as a result of these amendments, we should have the backlog eliminated in a matter of weeks. Any station involving remote control or an auxiliary link will still be required to make the showings for applications and modifications required by the remaining paragraphs of Section 97.41.

*Also deleted is the requirement that contour gradations on topographic maps only be 50 feet.

INTRUDER CHASE

Jonathan Tara WB8DBN
16260 Greenfield
Detroit MI 48235

The Intruder Net started operation on February 6. Right now it is planned to be weekly on Wednesdays at 9:00 PM EDT (0200 GMT Thursdays) on 7275 kHz. If there is interest it will be expanded. There will certainly be some schedules set up through the net. Initially the net will be to inform hams about intruders, to distribute information about intruders, exchange information, etc. Eventually it is hoped that enough of the members will equip themselves with direction finding loops so that it can be used to pinpoint intruders.

I've gotten a lot of mail about jamming intruders, none of it against. (Of course I haven't brought it up before.) I stayed clear of this subject, because I thought there would be a lot of conflict over it, but it seems that most hams have no objection to jamming in one form or another.

According to K6KA, the VK hams are authorized to jam intruders. As soon as I find out more about this, I will submit a petition to the FCC modeled after the Australian law. VKs seem to be among the most active in combating intruders. Organized jamming of intruders could be quite effective since most of the intruders on the list are illegal because they are broadcasting to the Western Hemisphere. That means that we are *in* the target area. We can have several stations around the U.S. jamming the same frequency, as well as hitting all frequencies of a multi-frequency broadcast, such as Radio Moscow's. All in all, I think hams are capable of setting up a jamming network the VOA would envy.

Such jamming, of course, is now illegal, but it has been made legal in Australia, so why not here? Of course, safeguards would have to be built in to make sure that only illegal foreign stations were jammed, and only those which are causing trouble. It makes no sense to try to jam a broadcast aimed at Europe, or one that is S3. Perhaps the FCC could provide a list of stations it is permissable to jam. This all sounds like a pretty "dirty" thing for hams to be doing, but then again they are the intruders, not us.

There is a way we can legally jam them now. Most of us think that the frequencies occupied by the broadcast stations are useless and avoid them. But these frequencies can be used for local QSOs. Providing the signal strength of the station you are talking to is high enough, you can just turn down the RF gain on your receiver until the broadcaster disappears. Of course to do this you must be zero beat with the intruder to eliminate the heterodyne from the carrier. This sounds like just the thing for those of you who want to talk to locals, but for some reason or another don't want to get 2m FM equipment.

The jamming effect of this is quite good. Although the useful communication range is small, the jamming carries much further. Additionally, if you are zero beat with the intruder, the SWLs listening on AM receivers will here you either over or behind the broadcast station. (That is, he'll be able to hear what you are saying, since the intruder provides the carrier.) There is also an element of privacy to the QSO, if you don't like people breaking in. Obviously, if only locals can hear you, you get no out-of-town breakers. Try it, I think you will be pleasantly surprised. I got a letter from one ham who says he's been doing this for more than 20 years.

In the last column I described what *you* could do about intruders. Now I'll tell you what *we* are doing.

I've contacted as many SWL clubs that I could find addresses for, asking them to print the Intruder list in their magazines, and to print a little piece describing what intruders are and which frequencies are illegal, etc. This should help a lot since the SWLs are whom these broadcasts are intended for. If *they* start complaining to the intruders, the intruders will have to move.

From the letters I have received most hams are misinformed about intruders, and SWLs are even more misinformed (If they know they exist.). I'm also trying to get the various DX programs put on by broadcasters to do a piece on intruders (Count the BBC out on this one. . .).

All reports received will also be forwarded to the ARRL and the FCC. When a number of reports have been received on one station, the station itself will be contacted. (For what good that will do.) However, it is important that the individual amateurs also contact the broadcast station. Ten letters from individual hams are better than one from us.

What else can we do? If you have any ideas, let me know. So far, jamming and getting to the SWLs seems to be the best bet. How about an ad in the World Radio TV Handbook? Most SWLs get this publication. I can imagine the impact it would have right next to Radio Moscow's ad. Let's play on *their* terms.

I need more reports from the West Coast. The intruder situation is quite different from there, due to the propagation. I also need reports from people who can understand the Spanish language broadcasts. Most of these are directed to South America, and are also illegal. If you need report forms, drop me a postcard. They should also be available from 73 "sales representatives" and swap and shops and hamfests. I prefer reports on the forms, since that way I can be sure of getting all of the information I need.

If you would like to receive the intruder list when updated (about 2 months before publication) just ask for it. If you write a letter and want the list, please ask for it or I won't send it. This is to make sure that the people I am sending it to are really interested.

Does anyone have information on good direction finding antennas? How about maps and overlays for plotting coordinates? These could be used in conjunction with the net to pinpoint unidentified intruders.

Let me know if you want information on intruders to pass out at club meetings (especially SWL clubs). I have a sheet describing where to find intruders, etc., for this purpose. If you do, be sure to pass out plenty of reporting forms also.

There seems to be a number of intruder watches in various countries, but apparently unconnected. I hope to get information flowing between them to try to develop an international intruder plan.

The BBC transmission "to Australia" has now shown up on 3952. If you look at schedules of other European broadcasters in the same time slot, you'll find they are using much higher frequencies. This is simply not possible at this time of the day. Also, there seems to be a number of broadcasters which operate on the edge of exclusive amateur bands. (Such as Trans World Radio on 7100 and Voice of America on 21450.) These transmissions are just as illegal as the others. You know what happens if *you* operate on exactly 21450!

WB8DBN

50 MHz BAND

Bill Turner WA0ABI
Five Chestnut Court
St. Peters MO 63376

50 MHz BAND

Virg WA0YNK says the band was open for two solid hours Christmas Day from Maine to Missouri but only Paul K1TOL, was around to work it from the Eastern end. January 1, the band was open for 4½ hours in this area. The initial two hours was exclusively to the Virginia area with stations worked in Norfolk, Colonial Heights and Chesapeake. Thereafter the cloud slowly drifted allowing contacts to 1, 2, and 3 land with numerous stations active. Started hearing 3's working 6's, then 8's, then 9's. Finally opened to 6 land from this area around 2230Z.

January 2, the band opened around 1845Z to Long Island in the North and the Florida Gulf Coast in the South. By the time it closed at 0300Z I had 22 states in the log including Oregon, Montana and Utah.

In general December was a bummer, the first week of January fair, thereafter nil. Contest weekend was a bust for Es although scatter and groundwave were good.

Steve WB0GAR, writes from Ottawa, Kansas to tell us he is on with a Clegg Venus and both a 5-element beam and a Ringo on SSB. Steve also runs a Regency HR-6 on 6m FM with phased 3-element beams at 30'. He says he doesn't find activity enough and inquires about 6m nets in his area. Anyone with net information is invited to drop Steve a line at Box 531, Ottawa KS 66067. While you are at it drop me a line too, for a column mention.

Andy SH-W5-109, is a shortwave listener using his fathers (WB5HVE) rig to DX on 6m. Andy says he didn't hear any of the October or November openings but mentions hearing WA7FHP and a VE7 on January 6. Andy does his DXing from Mountain Home AR.

Dave K0LCB says he will be moving into a new house before long and hopes to be back on 6 in time for the June contest, but says more realistically he expects to be on for the September version. In the meantime Dave is confined to FM operation from an apartment in Independence MO.

With the coming of the New Year WWV and WWVH have changed to C.U.T., Coordinated Universal Time. What is it? Nothing different, just another terminology. You may file G.M.T. along with cycle, micromicrofarad and other terminology which has faded in the past few years.

While on the subject of time, I would like to put in a plug for the use of C.U.T./G.M.T., or whatever you prefer to call it for logging purposes. Use of standardized time makes it ever so much simpler to check your log when QSLing. Everyone in every time zone is speaking the same language. Another small and at the moment unimportant feature is the elimination of the necessity of changing your clock with the change to Daylight or Standard time.

In the January issue of 73, in the letters column there was correspondence from WA5RER requesting information as to where a Heath SB-110 could be found. As it happened I had just a day or so earlier received the latest edition of "The Yellow Sheet," known officially as the Equipment Exchange and Ham Trader. This biweekly listing of items for sale, swap or wanted to buy, is without a doubt *the* place to find a needed piece of equipment. In the issue mentioned were two SB-110s for sale and being biweekly both were fresh, not lost in 2 or 3 months of magazine publication and distribution. Available on a trial basis of 5 issues for $1, the normal price is $4 for a 24 issue yearly subscription. The address is "The Ham Trader," Sycamore IL 60178. or see *Very INTERESTING* in Caveat Emptor.

WA0ABI

AMSAT NEWS

Mike Frye WB8LBP
640 Dauville Dr.
Dayton OH 45429

AMSAT

As of this writing all systems are progressing rapidly on A-O-B construction. The unit is undergoing preflight tests and all functions are being checked out. As far as a launch date please listen to the AMSAT nets, especially the one on Mondays at 8:00 EDT on 3855 kHz.

There have been a number of visual observations of OSCAR 6. Although the satellite is less than a yard wide it is still possible to see it at certain times as it reflects the sun. Anyone wishing information on how to optically track OSCAR 6 and other satellites may contact: Norton Goodwin, Director, ZIPSAT Information Services, 824 Connecticut Avenue N.W., Washington, D.C. 20006.

Orbital Information

Orbit	Date (Mar)	Time (GMT)	Longitude of Eq. Crossing °W.
6278	1	0045.5	59.1
6291	2	0140.4	72.8
6303	3	0040.3	57.8
6316	4	-135.3	71.5
6328	5	0035.2	56.5
6341	6	0130.1	70.3
6353	7	0030.1	55.2
6366	8	0125.0	69.0
6378	9	0024.9	54.0
6391	10	0119.9	67.7
6403	11	0019.8	52.7
6416	12	0114.7	66.4
6428	13	0014.7	51.4
6441	14	0109.6	65.1
6453	15	0009.5	50.1
6466	16	0104.4	63.8
6478	17	0004.4	48.8
6491	18	0059.3	62.6
6504	19	0154.2	76.3
6516	20	0054.2	61.3
6529	21	0149.1	75.0
6541	22	0049.0	60.0
6554	23	0144.0	73.7
6566	24	0043.9	58.7
6579	25	0138.8	72.4
6591	26	0038.8	57.4
6604	27	0133.7	71.2
6616	28	0033.6	56.1
6629	29	0128.6	69.9
6641	30	0028.5	54.9
6654	31	0123.4	68.6

Looking West

Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA 91402

LOOKING WEST

It's New Years Day, 1974. It's noon and the multitude of local repeaters are starting to come to life. VHF FM, Los Angeles style is beginning a New Year, one that we hope will bring to our hobby the change we have been hoping for since Docket 18803 was enacted. To accomplish that end many of us have contributed to a fund that will enable Marty Barrack WB6MFA, to attend the FCC hearings on January 14. Marty is an agent of the U.S. Customs Service. Hamwise he edits the monthly P.A.R.C. Bulletin.

Drive in, tune-up, tune-in and drive out! That was the theme of the December 9, "Tune-Up Party" sponsored by the Pallisades Amateur Radio Club of Culver City. Some of the most advanced spectrum analysis equipment was available to do the job, so it was easy to see what each transmitter was putting out and where. Just about every rig available to the ham on 2m FM was represented at the "Tune-Up Party," and the findings will be sent to the respective manufacturers for their evaluation.

No amateur wants his rig to interfere with his fellow amateur's or any other service. Tune-up parties such as this one are a means to that end. We have plans in the works for another such event, and the Mt. Wilson Repeater Association is also planning such an event. I hope that this idea catches on nationwide so that hams and those that build ham equipment will know how their equipment stacks up after over-the-air use.

If you and your rig ever make it out to Los Angeles don't be too surprised if you hear a 10-4 or a signoff with a 10-7. Your rig has not magically turned into a CB set. Many repeaters in this area use the land mobile 10-code in its original un-CB bastardized form. The hams didn't steal it from the 11m crowd. Most of the VHF FMers in this area who put up the first remotes and repeaters are in the commercial radiotelephone business and use of the 10-code system in amateur radio is a carry over from their profession. Not all repeaters here require its use, but if you do happen to here someone go 10-10, call him, he is looking for another contact.

And that concludes Looking West for this month. With any luck we will be back in 30 days to further update you on whats going on in the Sunny Southland.

WA2HVK/6

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List from Past Issues:

Mfr., Model, Ser. No.	Owner	Issue
AF68 No. 10888 PMR8 No. 10918 M1070 pwr supply	K5LKL	1/73
Trio TR2200 No. 241969	WA2ZBV	1/73
Clegg 22er No. 1900-578	W1DHP	2/73
Standard 826M, No. 112007	WA8PCG	3/73
FM27B No. 27013-1141	W2LNI	4/73
FM-144-10L No. F459 NPC 107m pwr supply 2, 5AJ-IPL Onan Gen., No. 327886	WA6WOA	4/73
R4B No. 11578G T4XB No. 17801 G W4 wattmeter No. 8300 Swan 250 No. F154806 Swan ac pwr supply No. 0653556	WA8GVK	6/73
HR-2 No. 04-C2879 SB-34 No. 21 1828	W6GSR	6/73
STD 826 No. 011268	WA2FSD	6/73
HT220 No. GJ7327	State Univ. of NY (Albany)	6/73
Yaesu FT-101 No. 82G 12279/CW HR-2 No. 0302030	W4GF	7/73
Clegg 27B No. 72013-1068	W3BXL	7/73
STD. 826 MA No. 208078	WB2DEW	7/73
Drake ML-2 No. 10582	W3MSN	8/73
Sonar FR-2528 No. 21-4250 STD SRC-851-SH No. 9725 STD SRC-707C No. 2833 TPL PA-6-IDE No. 1092 RP MEA-22 No. 212 Two Larsen antennas	Doherty	12/73
Swan 270 No. M-252616	W4NTB	12/73
STD SRC-146A No. 208078	W7DKB	12/73
Marker Luxury No. 2296	W7BVP/6	2/74
Regency HR-2A 2m FM No. 04-05632	WB8NSU	3/74
Collins Model KWM-2 No. 13561	W8JS	3/74

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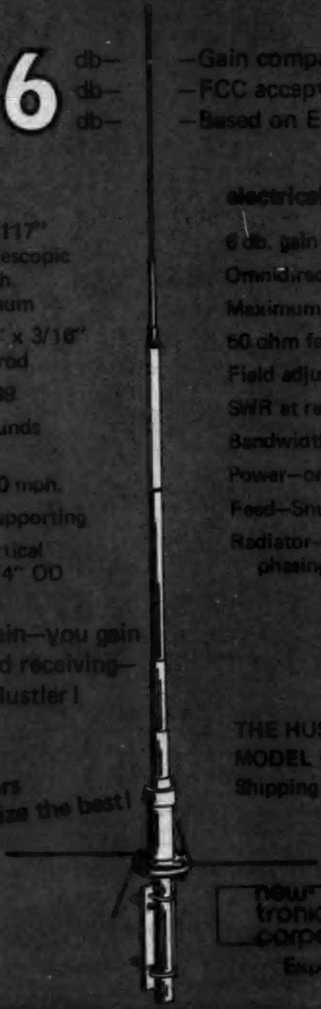

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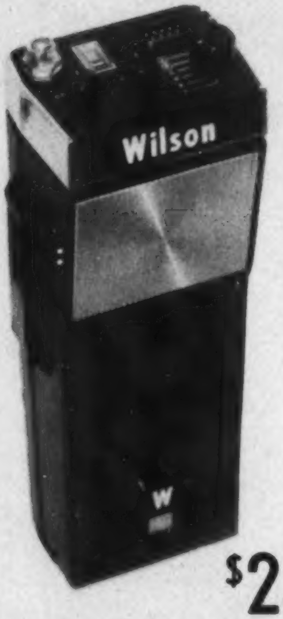

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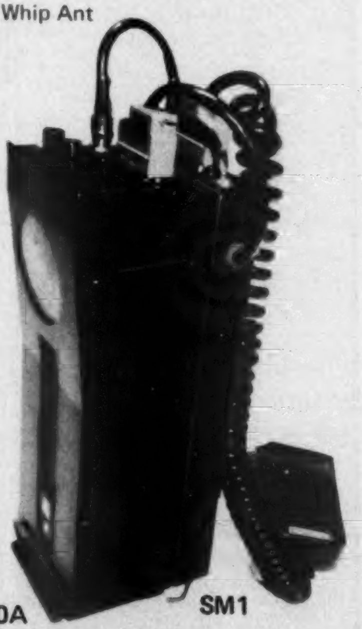

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SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

Independent sideband keeps growing in popularity, as evidenced by the interest and recent abundance of information on its use. (You didn't miss the fine article in 73 in November, did you?) The easiest approach to ISB is a phasing network for connecting two transceivers (one on USB running audio and one on LSB running SSTV) to a common antenna or linear, as in Fig. 1. If you have an extra sideband transceiver (like a mobile rig) or can borrow one, just rig up this network and join in on the action. Referring to Fig. 1; The network is made up of 3¼ wavelength and 1¼ wavelength pieces of coaxial cable. Since we are dependent on frequency of operation and velocity factor of the coaxial cable, formulas for finding exact cable lengths are included. For 50 Ω terminations of this network (rigs, linear or antenna) the cable should be 72 Ω. RG59 foam works nicely. Relays are suggested to bypass the "rat race" on receive but are not absolutely necessary. Our special thanks go to Dr. Don Miller W9NTP, for the information on this "shunt coaxial hybrid ring."

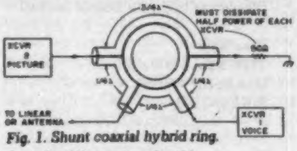


Fig. 1. Shunt coaxial hybrid ring.

$$\text{Length of } \tfrac{1}{4} \text{ wavelength cable} = \frac{492 \times \text{Velocity factor of coax}}{2 \times \text{Frequency (MC)}}$$

Example:

$$\text{Length of } \tfrac{1}{4} = \frac{492 \times .79}{2 \times (14.230)} = 13.65'$$

note: .79 is velocity factor of RG 59 foam.

$$\text{Length of 3/4 wavelength cable} = \frac{3\text{X } 492 \times \text{Velocity factor of coax}}{2\text{X Frequency (MC)}}$$

A few month's back I had some information in this column on the weather satellites that were transmitting faxsimile pictures, and the interest was tremendous. I know you will be glad to hear that there are a couple of articles on this coming soon in 73. Recapping briefly, the satellites mentioned transmit on 136 MHz, thus a modified "scanner," 2m rig, etc., could be used for reception. After acquiring a nice, full quieting signal, the next step is a "readout" unit for picture reception. There are basically two methods of accomplishing this. Fig. 2A and 2B, demonstrate these.

In Fig. 2A, the audio output of the receiver is fed to the "converter," which in turn drives a faxsimile unit. (Types range from elaborate commercial to inexpensive deskfax units.) This is probably the less expensive method of receiving pictures on a long term basis.

The system in Fig. 2B, reminds one of the old 'scope adapter approach to SSTV. Indeed, it is very similar since it provides horizontal and vertical deflection, plus crt video modulation to an oscilloscope. Since a picture readout is very long (approximately 3 minutes) a photograph is taken of each frame, or picture, and when developed this yields high quality faxsimile pictures. Although this method is slightly more time consuming and expensive (due to film cost) the results are much better. A tape recorder may be used with either system for taping transmissions during satellite passes, then processing the pictures later when solid copy frames are definite. Specific details on the satellites as to frequencies, locations, and times of transmissions, etc., were given in the October 1973 SSTV Scene column. Incidentally, the ATS-1 and ATS-3 satellites mentioned in that issue are 22,300 miles high, not 4,000 miles as stated.

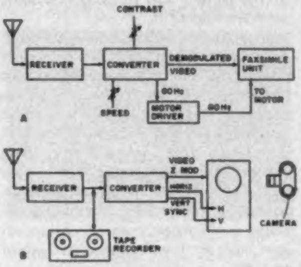


Fig. 2A and B. Reception setup for copy of APT Satellites.

An interesting device has been developed by MS laboratoris of Box 28425, Dallas TX 75228, for compressing and expanding audio bandwidth in an effort to more efficiently use spectrum space and improve signal to noise ratios. The unit shows possibilites for Slow Scan TV, so this month we have a brief description.

Basically, this unit uses hetrodying and balanced mixed principles to compress audio in the 300 to 2400 Hz range to (for example) 300 to 1000 Hz. In doing this we could put SSTV and audio on the same sideband, as shown in Fig. 3. Notice the arrangement of Fig. 3, it would be compatible with present SSTV standards.

Leo Cavanaugh K1GRT, carried this a little further and came up with the idea shown in Fig. 4. Sharp filters would naturally be required, however, the end results could show *some* advantages over the ISB method.

Another possibility with the frequency compression and expansion units might be to use higher scan rates and 2-second frames, compressing and transmitting this information, then expanding it after reception. Theoretically this would yield high resolution 480 line type pictures. Frequency compression would be necessary because, applying the Channon Theory, bandwidth increases as scanning frequencies (and definition) increase. I should point out the previously described method has not been proven in actual practice, so its validity may be questionable. This is because SSTV is basically a time sample format, and decreasing its bandwidth could mean less "samples," which would result in less definition. Further experimentation and advancements in the previously mentioned ideas could prove quite fruitful to the SSTV future.

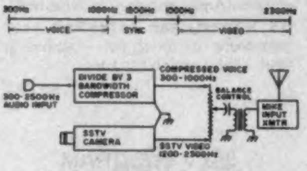


Fig. 3. Spectrum analysis of a sideband.

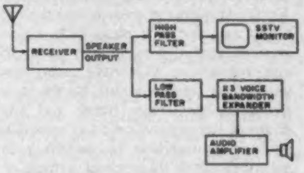


Fig. 4. Voice and video on one sideband.

Ralph Taggart WB8DQT, reports quite a few of his SSTV monitor boards have now been sent out, so we should be hearing from some of the fellows using this fine unit in the near future. (The monitor article appeared in August 1973, 73 Magazine, page 45.) I understand commercial SSTV gear sales are also up, which indicates Slow Scan is definitely gaining in popularity.

This month's column marks my 24th straight here in 73 Magazine. Two years ago I started sharing my enthusiasm with you, and I sincerely trust the items presented here have been of particular interest to you. I would be quite interested in hearing your comments and suggestions, to assure a continuing informative column. There is a special feeling that

Continued on page 12

comes with seeing your own words in print, (especially in such an outstanding field as SSTV, like the majority of my articles have been) and I would like to encourage more of you to write up those favorite circuits, ideas or "pet projects" and submit them as articles (And hope they're accepted!). It's a great way to expand your enjoyment of an already fascinating field. . .why not give it a try.

K4TWJ

SSTV PROGRAM CONTEST WINNER

Thomas Bradley K4GXO

The poor mailman had to do double duty during the last few days of 1973 as entries in the Slow Scan Program Contest arrived to beat the December 31st deadline. Sack after sack of them arrived, making the contest judging into a major event.

The winning entry, by Thomas Bradley K4GXO, was "Ham to the End." It pictured an amateur driving along and seeing a chap with a sign warning that the world was going to end tomorrow. Our hero, who has worked all zones but one, thinks for a moment, then races home and sits down at the rig and calls CQ zone 18, obviously intending to continue at this until either the contact is made or the world ends.

Tom is the winner of the first prize in this contest, a Robot fast scan unit – something every slow scanner needs. It was most kind of Robot to offer this fantastic prize for the contest. One of the benefits of a contest like this, where nothing is sent over the air, is that it is possible to offer prizes such as this fast scan unit. The FCC rules have been interpreted by the Commission as prohibiting any prizes with actual value for on the air contests – something to do with the "without remuneration" part of the rules.

The second prize in the contest was won by Connie Owens WA1NXR, of Eliot, Maine. This was a very smoothly produced program about the New England winter – beautifully done. Connie is the winner of a Linear Systems camera lens, an F 1.9 25mm job which is ideal for slow scan. This lens will focus down to about 19". Many applications of slow scan call for getting down close, and this lens will do it. One excellent use is for working with a 35mm projector and a small screen.

Probably the best of the many runner's up was a humerous program by K8BTU which featured several cartoon characters.

Many of the better entries leaned heavily on humor, subtle and unsubtle. One, entitled "Love Story," had a couple shown running toward each other – only to pass at the last moment as the ham went on to operate his rig.

Thanks are due to all of the slow scanners who participated in the contest. Hopefully some of the ideas generated for the contest will perk through and result in an improvement of the general run of programs being sent over the air.

It might be well to have two types of programs available, one for poor conditions and the other for closed circuit copy. There is no point in repeating frames when you know that every one will get through. In general you know how well you are doing before you get into much of a slow scan exchange. Conversely you want to keep it simple when conditions are rough – your call, name, location, all sent several times – probably white on black.

A cassette of the winning entries in the Slow Scan Contest plus 10 of the best runner up entries (totalling 12 shows) is available from 73 for $4.00.

NEW PRODUCTS

TOUCHTONE DECODER

Cepco has come out with a simple decoder that should find many applications. Individual operators will be able to use it as an autocall device to turn on their speaker when the proper three or four tones are received. Repeater groups can use it to decode access tones to permit phone patches or other operations of the repeater.

Autocall, if it becomes popular, could lend a whole new dimension to amateur radio. How many times have you missed talking to someone because you weren't monitoring? How many times have you had a sked and remembered it a half hour late? How many times have you tried to get someone via a repeater and missed them. They were probably just wasting their time watching television or reading, and an autocall unit would have made all the difference.

HAM HELP

This column is for those needing help in obtaining their amateur radio license.

If you are interested, send *73* your name, address and phone number. Don't be bashful – remember, it's always easier when you have someone to give you that added bit of confidence.

73 would appreciate amateurs and clubs looking this list over and helping whoever they can. Do you remember when you needed help?

R. Gary Hendra WN6SUW/6
Stern 217 Twain
Stanford CA 94305
(Would like help with General license.)

Mike Mey
4925 Brookside Road
Menton OH 44060
216-257-7565

The Cepco unit is about as simple to use as can be. You feed in audio from the receiver and 12V dc. Out comes audio for the speaker or a repeater. A switch on the front bypasses the decoder when you want to check the receiver or use it normally. There is a light on the front to tell you if you were called while you were not there to hear the call. Obviously, with a simple tape recorder you could arrange it so messages could be waiting for you. Charlie could give you the beep-beep-beep and leave word that he'll be looking for you at 9 PM.

The Cepco can be set up with any set of three or four tones, which must be received in the right sequence. It is virtually foolproof, which is important for an autocall unit.

For more information write to Cepco, Box 189, Duncanville TX 75116.

NEW RACK MOUNT DISTRIBUTION AMPLIFIERS

Ramko Research of Sacramento CA has introduced a new line of rack mounted audio distribution amplifiers with up to 32 completely isolated balanced outputs. These low cost units feature individual output amps for maximum isolation.

This Ramko series includes five models. The DA-6R features six balanced 600 ohm outputs with level control pilot light, ON/OFF switch and fusing and audio input/ouput barrier strips on the rear. The DA-6BR has in addition six individual front panel level controls. The DA-6RS offers 6 stereo pairs or 12 mono out with 2 inputs. The DA-16BR and DA32BR provide 16 and 32 completely isolated balanced outputs with metering, switchable to monitor outputs, balanced bridging/matching inputs for each group of 8 outputs, and individual level controls with headphone monitor jack.

For more information contact: Ramko Research, 3516-B La Grande Blvd., Sacramento CA 95860. Tel. Number: 916-392-2100.

MCM14537, 256-BIT RAM MAKES DEBUT

Motorola Semiconductor Products Division has announced the addition of a 256-bit static random access memory device to the proprietary series of the McMOS product line. Applications for the new device include portable instrumentation, industrial control systems, and other areas which require medium speed at micropower operation with exceptional noise immunity such as scratch pad and buffer functions. Four of these devices may be used to build a 1024-bit RAM without additional address decoding provisions. An output decoding latch elimiates the need for a storage buffer function; the wired-OR output capability provides three-state operation for memory expansion.

Two device versions are available in accord with system temperature requirements? The AL suffix denotes the full military temperature version and the CL suffix denotes the standard commercial version. Both are available in the type 690 ceramic DIP configuration. For more information contact: Technical Information Center, Motorola Semiconductor Products, Inc., Box 20924, Phoenix AR 85036.

CLAMP METER FOR VOLTS/AMPS/RESISTANCE

Panasonic has introduced a clamp meter that measures volts, amps and resistance. To measure current simply clamp the meter around one conductor and read the current on the graduated scale. Current ranges to 1200A, voltage ranges to 600V and resistance measurements to 5000Ω are standard.

Although the clamp meter is small in size and light in weight, it is very easy to read due to the slope design of the meter scale. The meter also comes equipped with lead wires for voltage measurements, a special adaptor for resistance measurement, and a deluxe carrying case. Two models are available, the model 300/600 measures wire sizes to 1.02 dia. and the model 1200 measures wire sizes to 1.889 dia.

Price and delivery are available from: Panasonic Industrial Division, 200 Park Avenue, New York, New York 10017.

DIGITAL RF WATTMETER

The model 4371 THRULINE Directional High-Power Wattmeter is the first digital insertion instrument for measuring forward or reflected CW power in coaxial transmission lines. It accurately measures power flow under any load condition from 25 to 520 MHz and from 1-1000 watts in six ranges. Model 4371 is also the first High-Power Directional Wattmeter which the user can calibrate in the field to known RF power standards, eliminating weeks of transit for periodic certifications.

This Wattmeter measures CW, AM, FM and SSB signals. Its digital readout makes it ideal for production testing and continuous service applications since the information is displayed with the decimal point in place. No Plug-in Elements are needed since all variable measurement parameters — frequency range, forward/reflected power and full scale values — are pushbutton selectable right on the front panel. The readout unit and the line-section may be separated by as much as 5 feet for operation convenience.

For more information contact: Bird Electronic Corporation, 30303 Aurora Road, Cleveland (Solon) OH 44139.

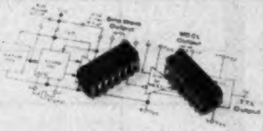
LINEAR IC DATA BOOK

Motorola's 3rd Edition of the Linear Integrated Circuits Data Book is just off the press and has been expanded to over 800-pages, 100-pages more than the previous edition.

In addition to device listings and data sheets, an interchangeability guide and listing of available Application Notes is included. Package outlines, pinouts and numerous schematics are abundantly provided. At $3 per single copy it is a bargain buy for the solid state bookshelf.

The Linear Integrated Circuits Data Book may be ordered from Motorola Semiconductor Products, Inc., P.O. Box 20924, Phoenix AR 85306, or from your Motorola Franchised Distributor.

LOW–COST CRYSTAL OSCILLATOR



Ideal for reference oscillator and clock applications, the new crystal oscillator features a choice of complementary sine wave, single-ended MTTL, and complementary MECL outputs from a single IC chip. Designated the MC12060/12560 for operation from 100 kHz to 2.0 MHz, and the MC12061/12561 for the 2.0 to 20.0 MHz range, these devices operate with a fundamental series mode crystal. Stability is excellent, averaging -0.08 parts per million/degree centigrade (ppm/°C) for the MC12060/12560 -0.16 ppm/°C for the MC12061/12561 devices. The wide range of output combined with the high-stability make these new circuits ideal for many phase-locked loop applications.

The medium-scale integrated circuit consists of a voltage regulator, an oscillator, an amplifier/automatic gain control, a sine to MECL translator, and a MECL to TTL translator. The only external components required to produce a highly stable oscillator are the crystal and two bypass capacitors, plus usual power supplies. Operation is from a single power-supply. Sine wave output voltages range from 800 millivolt peak-to-peak (no load) to 500 mV p-p at full load.

Currently available in a 16-pin, dual-in-line ceramic package the 12060L/12061L and specified over the 0 to 70°C temperature range and are priced at $4.35 each in 100 to 999 quantities. The MC12060/12560 operate from 100 kHz to 2.0 MHz and the MC12061/12561 cover the 2.0 to 20.0 MHz range. The full military temperature operation (-55° to +125°C) is specified for the MC12560/12561 devices and will be available soon.

For more information please contact the *Technical Information Center, Motorola Inc., Semiconductor Products Division, P.O. Box 20924, Phoenix, Arizona 85036.*

73 REPEATER ATLAS REGISTRATION

REPEATER CALL (WR only)	FORMER CALL	LOCATION (City)	STATE

INPUTS	OUTPUTS	TT Wh TB PL	FM AM RTTY	AUTO PATCH	ERP	
		Hz				USEFUL RANGE (RADIUS)
		Hz				
		Hz				EQUIPMENT
		Hz				☐ SPLIT SITE
		Hz				ANTENNAS & HEIGHT ☐ DIPLEXER

REPEATER GROUP/SPONSOR	TRUSTEE	ID–TYPE OR MFR.

☐ I certify that I have received no outside assistance while completing this form. DATE	SOURCE (NAME/CALL)	SPECIAL OR EMERGENCY FUNCTIONS

REPEATER UPDATE
LISTENING
94 76 88 73 70 64 82. . .

AL	WR4ADJ	Florence (former call: W4JNB)		146.01-146.61
CA	W6NRY	Johnstone Peak (former call: W6FNO)		146.22-146.82
CA	WA6ALV	San Bernadino		146.25-146.85 223.25-224.86
CA	WR6ABJ			
AL	WR4ADJ	Florence		146.01-146.61
CA	W6NRY			
AL	WR4ADJ	Florence (former call: W4JNB)		146.01-146.61
CA	W6NRY	Johnstone Peak (former call: W6FNO)		146.22-146.82
CA	WA6ALV	San Bernadino		146.25-146.85 223.26-224.86
CA	WR6ABF	Mt. Wilson (former call: WA6TDD)		147.435-146.40
CA	WR6ABJ	L. A.		146.07-146.67 223.26-224.86
CA	WR6ADH	Monterey Park (former call: K6DIR)	T1.8	147.87-147.27
CT	WR1ABR	Stamford		146.055-146.655
FL	WR4AER	Orlando		147.12-147.72 444.5-449.5
GA	WR4ABH	Rome (former call: W4VO)	W2.1	146.34-146.94
IA	WR0ACU	Iowa City		146.28-146.88
IL	WR9ABY	Chicago (former call: WA9ORC)		146.16-146.76 443.75-448.75
IN	WR9ALI	Anderson (former call: WA9WVC)		146.22-146.82 146.34-146.76
MI	K8WNJ	Muskegon	T2.25	146.22-146.82
MI	WA8PUD	Grand Rapids	T2.4	146.34-146.94
MI	WB8HEE	Whitmore Lake		146.13-146.73
MI	WR8AAA	Milford		146.19-146.79
MI	WR8ABI	Kalamazoo (former call: K8TIW)		146.19-146.79
MI	WR8ABZ	Jackson (former call: WB8CSQ)		146.28-146.88
MI	WR8ACF	Detroit (former call: K8VLH)	PL	146.04-146.64
MO	WR0ACT	Independence		147.69-147.09
MS	WR5ACC	Jackson		146.16-146.76
MS	WR5ABT	Jackson		146.28-146.88
NB	WR0ABA	Bellevue		146.04-147.30
NJ	WR2ACQ	Northfield (former call: K2CIR)		146.16-146.76
NY	W2CXM	Ithaca		DELETE
NY	WR2ADA	Utica		146.16-146.76
NY	WR2ABD	Tompkins County		146.37-146.97
NY	WR2ABK	Staten Island		CLOSED
NY	WR2ACV	Brooklyn (former call: WA2ZWP)		147.43-146.43
OH	W8WTB	Columbus		146.16-146.76
OH	WR8ABC	Cleveland (former call: WB8CQR)		146.28.146.88
RI	WR1ACE	Lincoln (former call: WA1OZF)		146.16-146.76
RI	WR1ACG	Johnston		222.38-223.98
SD	WR0ACK	Sioux Falls		146.16-146.76
TN	WR4ADD	Kingsport		146.16-146.76
TX	WR5ABA	Dallas		146.01-146.61
WA	WR7ACJ	Seattle		146.37-146.97
WV	WR8ACJ	Parkersburg (former call: WB8CRO)		146.37-146.97
Foreign Canada	VE3TIS	Timmins		146.34-146.94
England	GB3BC	Pontypool		145.15-145.75

TOUCHTONE FOLLIES

GOOD NIGHT, LADIES

9 7 4 4
Good night, lad-ies,
9 7 2 2
Good night, lad-ies,
9 7 0 0
Good night, lad-ies,
9 6 6 5 5 4
It's time to leave you now.
6 5 4 2 3 3 6
Merr-il-ly we roll a-long,
5 5 8 3 3 6
Roll a-long, roll a-long,
6 5 4 2 3 3 6
Merr-il-ly we roll a-long,
6 5 5 3 2 1
From sea to shi-ning sea

THE OLD GREY MARE

4 4 4 4
The old gray mare
8 6 6 8 6 8 4
She ain't what she used to be
8 8 4 8 8 4
Ain't what she used to be
6 6 8 6 8 4
Ain't what she used to be
4 4 4 4
The old gray mare
8 6 6 8 6 8 4
She ain't what she used to be
8 8 8 6 8 4
Ma-ny long years a-go

REPEATER OWNERS

Don't Take Chances. SENTRY offers custom made crystals made exactly to your specifications. When it comes to crystals for your repeater, BUY THE BEST – SENTRY.

REPEATER USERS

If you want reliable access to the repeaters in your area, you want and need SENTRY CRYSTALS. SENTRY CRYSTALS are custom made for your rig. We don't stock a large quantity of crystals for a certain frequency and hope you can tweak them to frequency in your rig. We do offer FAST service on crystals made especially for you and your rig. If you want reliable, on-frequency operation, INSIST ON SENTRY.

SENTRY MANUFACTURING COMPANY
Crystal Park, Chickasha, Oklahoma 73018

PHONE: (405) 224-6780
TWX-910-830-6425

DX FOOTNOTES

By: Gus M. Browning, W4BPD
Drawer "DX"
Cordova, SC 29039

Two days after I had written about SY5MA being active and handing out Mount Athos contacts I find that he had to all of a sudden "flee" the country (he was actually living in Greece, near the Mount Athos border). It was really a shame too, because he was just about to get rolling over there and I am sure that if things had not went wrong he would have had Mount Athos off the "rare country" list in a short order. He is now in Penna. and I guess about to again become active chasing his first love, DX.

I keep hearing that the sunspots is just about at their minimum, and a few even say it has passed and then a couple of the "experts" say it will be late this fall or coming winter before the minimum is reached. As for me, about all I can say is that there certainly is a lot of good DX being worked, regardless of the sun and its spots. If it gets any better when the spots get more numerous you will have rare DX QRMing rare DX ! It will be nice, though to have good 10 meter conditions and all nite 15 meter openings (and 20 too at times-, especially those winter nites). During this coming, up-hill climb of the sun-spots I have high hopes of being in a rare one or two myself, the old DX spirit is still "in there", it has not been asleep, just resting up" a bit !

With the energy shortage I would think that there would be a lot more fellows in there chasing the DX than usual, because if they can't be in the car running all over, then they will be at home and chasing DX is certainly better than "twiddling their thumbs". As for myself I have been having some great fun building up a bunch of solid state "gadgets". So far have built up a very FB, solid 100 kc xtal osc, xtal in an oven and have been zero beat with WWV now for well over a month. Wont mention other items built right now, but I am learning a lot about those little solid state "things", because you can be sure they are here to "stay", and those hot tubes are on their way out ! !

I have been talking with a number of DX'ers who have found a new interest in DXing via "Amstat". A few have worked as many as 43 different countries and they all say it is just a matter of time before someone makes WTW-100 or DXCC via the satellite. Some fellows are using only about 5 watts to a fairly simple antenna. He was telling me that the antenna he used consists of only about 8 yagi elements all on the same boom. It seems as if most of the fellows are using cw at the time this is being written. The nice part about this way to work DX is those sun-spots don't bother y0u because most of your contacts are the "line-of-sight" way. If any of you are tired of DXing the old way, I strongly suggest that you try working DX via Amstat ! Sounds very interesting to me, especially now with the sun-spots so low - try it ! A number have already made WAS. The first two I know of are W3TMZ and W6EJJ (2 old time DXers from the other bands) and VE2BYG was getting very close to his WAS.

Still plenty of new ones for the prefix chasers, seems as if they will never run out of new prefixes. Every little event seems to bring forth a few new prefixes. If any of you would like to try out a new prefix you might think of operating at your county fair, your city anniversary, state anniversary or maybe a Boy or Girl Scout Jamboree. I am sure you could come up with some good reason for FCC to issue you a "Temporary Prefix" to celebrate the occasion.

Still no sign of operation from such rare ones as, Iraq, Burma, South Yemen (ex-Aden-VS9-land), China, Tibet, Royal Knights of Malta (in Rome, Italy !), Zanzibar proper, and a few more that don't come to mind at the moment. Or maybe with the new China friendship things might be worked out with both China and Albania whereby an American could operate from both of these spots. I would think the approach would have to be worked out from a "high level". Maybe Wayne Green could do like he did with the King of Jordan.

I would like to hear from as many readers of this column as possible with suggestions as to what they would like to see more of and also "less of". I am sure that many of you have some FB suggestions and some have a few personal "gripes", well here is your chance to be "heard" ! I can give you QSL info until it runs out of your ears, or I could fill the entire page with pictures, if that's what you want. Up to now I have been trying to very broadly cover anything that has a DX slant so as to have a little of everything. So how about this fellows ? My full address is at the top of each article, every month.

A FEW BITS OF QSL INFO:

VE3AII/SU - Alan Leith, 200 Willett St
Apt. 525, Halifax,
Nova Scotia, Canada

DX (the prefix DX) was used by stns. in the Phillipines during their 41st anniv. in late Nov. early Dec. of '73. Send ur cards to the appropiate DU call sign.

HH2WF via WA2JDT
3D6AZ (ex-3B8CZ) to: D. Mather,
P.O. Box 626, Manzini
Swaziland, Africa.
4W1BC via G3SUW
9U5CR-via ON5TO
W4BPD DXpeditions (all of them)
QSL via Herman, W2MZV
VU2ABO via HB9ABO
VU7GV via Sulu, I.S.P.W.
Port Blair, Andaman Is.
Via India
WB4BUQ/8R1 via WA6MWG
ZE8JN via WB4VUP
5T5LO via K4KXA with SASE pse.
9J2BL via RW65, Lusaka, Republic of
Zambia with 5 IRC's if you
want an air mail reply.
9J2PH via Bureau
HK0BKX via WA6AHF
MP4BJP via WB4WPP
5V7GE via Box 196, Atakpame
Togo, West Africa
9K2DC via Box 77, Kuwait, Persian
Gulf
TF3AW via P.O. Box 1058,
Reykjvik, Iceland
ZB2CS via W9JVF
9X5NA via W7LFA

If any of you "happen" to go to The Dayton Hamvention (in late April) be sure to take your camera and a good, fast re-cycling electronic flash. You will have plenty of "Big Shots" to photograph. Don't miss visiting the North Jersey Suite almost any night during the convention. (Oh Yes Wear your high hip boots, the stuff gets a little deep around midnight) ! The picture shown below was snapped one night in the N.J.D.X.C. Suite last year. (Tnx to WB8HAT for pix). Left to right is K4MQG, WB8HAT, K7CBZ (1S1A, XV5AC) and W1YRC. (they were probably real "happy" an hour or so later on !-hi)

Peggy and I have our hopes high to again be there this year and we will be looking out for our friends. Lets all hope those sun-spots will soon become more numerous and all the bands will began to "crawl" with rare DX again.

Got ur autotransformer ready yet ? Mine will step 90v up to 120 ! In case its ever needed - Brown-outs, maybe ! That's it for this month-73 Gus BPD

David Horton K8JNE
P.O.Box 791
Jackson MI 49204

THE SENSUOUS CAVITY

One of the greatest and most positive influences on Amateur Radio to date, as activity and commercial sales prove, is 2 meter FM. Repeaters, autopatches, and solid-state transceivers have become commonplace in today's headlines and QSO's. As the Fraternity's equipment and knowledge advances, it is also common to be affected by the problems of transmitter noise and spurious, receiver desensitization, and intermodulation interference. The purpose of this article is to discuss the causes and cures of these problems and familiarize the reader with one of the most effective and practical weapons available, the cavity. Although this discussion certainly involves repeaters, more generally it pertains to all VHF transmitting and receiving apparatus. The format is intended to be philosophical rather than mathematical.

Transmitter Spurious

Most of the output energy of a transmitter is contained within the narrow band of frequencies corresponding to the intended transmit channel. Unfortunately, some unwanted energy is also present outside of the channel as a result of sideband noise (white noise), birdies, harmonics, etc. It is the responsibility of the licensee to minimize this spurious energy to the degree that it does not interfere with other spectrum users. The typical 2 meter transmitter radiates enough noise to degrade the performance of a receiver operating several megahertz and several thousand feet away and transistor circuits usually generate more than vacuum tubes. This type of interference cannot be corrected at the receiver since the noise is coincident with the receiving frequency. It must be removed at the transmitter. Most communities have enough activity on various channels to make it imperative for stations with high effective radiated power to take special precautions to prevent spurious radiations.

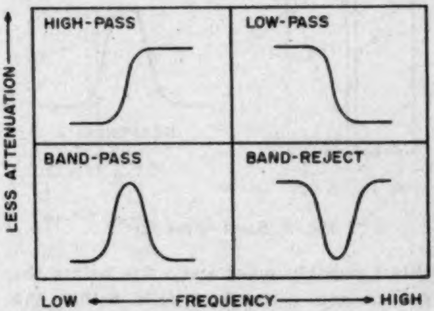


Fig. 1. Filter response curves.

Receiver Densense

Although transmitter sideband noise interference is sometimes included in the category of receiver desensitization, more commonly, the term desense is used to identity the situation where a strong off-channel signal overloads the receiver front–end, changing critical voltage and current levels to the degree that receiver performance is degraded at its operating frequency. This problem can be recognized by noting that the receiver limiter current from a weak signal will drop when a strong off–channel transmitter operates. Desense must be corrected at the receiver since it is not a transmitter fault.

Intermod

Intermodulation interference is caused by two or more signals of different frequencies mixing to produce undesirable intermodulation products. Although this mixing usually occurs in the receiver front–end or transmitter final amplifier, it can actually occur in any non–linear device, such as a dirty guy–wire connection. Intermod is identifiable by noting that the interfering signal may cease in the middle of a conversation, corresponding to when one of the signal sources ceases to transmit.

Generally, receiver intermod results when several external signals eminating from transmitters possibly miles away mix within the receiver and a product falls within the receiver's passband. This type of interference is caused by a deficiency in the receiver, not the transmitter.

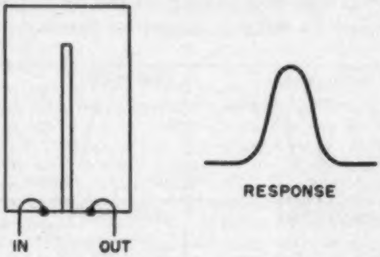


Fig. 2. Band–pass cavity.

The common cause of transmitter intermod is a surprise to most. Here again, intermodulation products are generated from the mixing of several signals. However, the mixing takes place within the final amplifier stage and involves one or more external signals that enter the transmitter thru its own antenna and then reradiated as an undesirable product. This phenomenon normally occurs only when several transmitters are operating within a few thousand feet of each other and it must be corrected at the mixing transmitter.

Filters

Since the topic of design and maintenance of transmitters and receivers is beyond the intended scope of the discussion, let us assume that the equipment is designed and maintained reasonably well and that general housekeeping has been done, such as shielding, tuning, matching, etc. This brings us to a topic of filters.

There are several electrical characteristics commonly referenced when evaluating a filter, some of which are easily understood, such as power capability and insertion loss. However, the frequency response characteristic requires careful interpertation to rate the device's performance. Generally speaking, there are four categories of response: high–pass, low–pass, band–pass, and band–reject. Refer to Fig. 1.

High–pass and low–pass filters, as their names imply, pass frequencies either above or below a cut–off frequency and attenuate all others.

Band–pass is the characteristic of passing only a band of frequencies within the spectrum and attenuating all others above and below the pass–band. Band–reject, also called notch or stop–band, is the passing of all frequencies except a band of attenuated frequencies.

At VHF, the passive L/C circuit is the most common and practical filter. It can materialize in a variety of forms, ranging from the low Q coil and capacitor tuned circuit (also called a helical resonator) to the high Q resonant cavity.

Cavaties

At microwave frequencies, a cavity is an empty resonant box. However, the dimensions of a resonant box for the 2 meter band wouldn't fit thru the average doorway, so the resultant compromise is a 1/4 wavelength resonator enclosed within a conductive housing. This device, still called a cavity filter, exhibits a Q much greater than the ordianry helical resonator and operates in either the band–pass or band–reject (notch) mode. Refer to Figs. 2, 3, 4, and 5 for

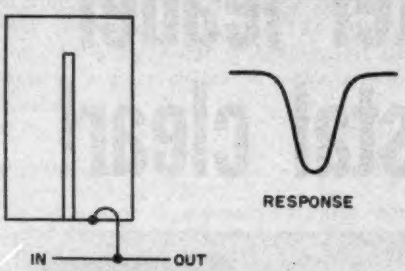


Fig. 3. Parallel connected band–reject cavity.

configuration and response illustrations.

Cavities are used for eliminating noise, spurious and intermod from transmitter emissions and for imporving receiver front end selectivity to eliminate receiver intermod and desense. Performance can generally be improved by cascading cavities.

The band–pass cavity has the advantage of attenuating all frequencies outside the pass–band rather than just attenuating a limited band of frequencies as with the band–reject cavity. However, the band–reject cavity is preferred where the frequency to be rejected is quite close to the frequency that must pass, for example 200 kHz to 1 MHz. The average band–pass cavity becomes inefficient when the separation between pass and reject frequencies is less than 2 MHz but it does outperform the band–reject cavity for wide separations.

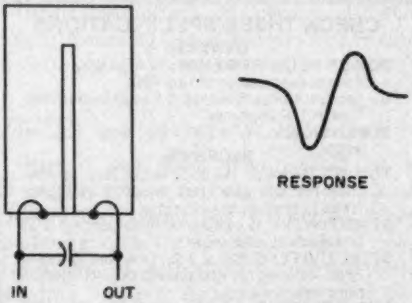


Fig. 4. Series connected band–reject cavity with capacitive reactance anti–resonant node.

Low impedance interfacing to the cavity is accomplished with coupling loops. The amount of coupling greatly affects the delicate balance between insertion loss and selectivity. Minimizing coupling enhances the Q.

A major problem with home–brew cavities is temperature stability. A high performance cavity can shift dozens of kHz for only a few thousandths of an inch change in the dimensions of the center resonator. One technique to improve stability is to use special metals with zero or complementing expansion coefficients. Commercial cavities are available within a price range of $25 to $350.

Duplexers

The duplexer is a device that connects a transmitter and receiver to the same antenna and allows concurrent operation. Although a "T" connector may fit this definition, the radio–man expects to see a passive network of from 2 to 6 cavities inter–connected in either a band–pass or band–reject configuration that provides 50 to 100 dB of isolation between transmitter and receiver ports.

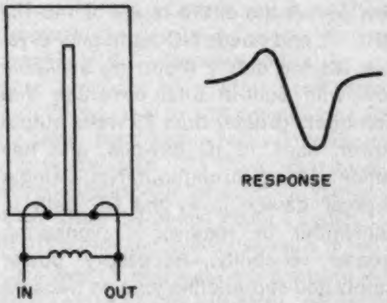


Fig. 5. Series connected band–reject cavity with inductive reactance anti–resonant node.

The band–pass duplexer is preferred for wide frequency spacings. In addition to providing the required isolation between transmitter and receiver, it also improves overall receiver front–end selectivity and attenuates all transmitter noise and spurious that occurs outside the duplexer's passband.

The band–reject duplexer is used for close frequency spacings, such as our current repeater 600 kHz standard. However, it does

The 2 meter leader that's crystal clear!

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VOLUME
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PULL TO SPOT
OFF
Clegg
FM-27B
TRANSMIT CHANNEL

The modified Clegg FM 27B transceiver now covers the entire range of 146-148 MHz . . . and needs NO additional crystals. It's the only 2 meter rig *available now* with built-in total coverage that also offers greater than 25 watts output power, uses 10 IC devices, and has Teflon* wiring throughout. Not a single bi-polar device is in the RF path in transmitter or receiver . . . ensuring greater reliability. Accessory power supply and sub-audible tone on transmit are available too. At home or in your car, the FM 27B gives you the ultimate in total 2 meter performance. See your Clegg Dealer NOW or write or phone us today for detailed data sheet on our 2 meter leader.

***Amateur Net* $479.95**

CHECK THESE SPECIFICATIONS

GENERAL

POWER REQUIREMENTS: 12 to 14 VDC
Current Consumption at 13.5 VDC:
Receive: 4 amps squelched, 1.2 amps unsquelched.
Transmit: 6 amps max.

DIMENSIONS: 7⅛" x 3½" x 9¼" deep; 4 lbs. net weight.

RECEIVER

TUNING RANGE: 146.00 to 148.00 MHz, continuously tuneable with reset capability of approx. 1 KHz to any frequency in range.

SENSITIVITY: .35 μv max. for 20 db quieting; .1 μv for reliable squelch action.

SELECTIVITY: 11 KHz at 3 db; Less than 30 KHz at 70 db. Adjacent (30 KHz spaced) channel rejection more than 70 db.

AUDIO OUTPUT: 2.0 watts (min.) at less than 10% THD into internal or external ohm speaker.

TRANSMITTER

TUNING RANGE AND CONTROLS: Same as RECEIVER.

POWER OUTPUT: 25 watts Min. into 50 ohm load. P/A transistor protected for infinite VSWR.

MODULATION: Internally adjustable up to 10 KHz deviation and up to 12 db peak clipping.

*DuPont trademark

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not contribute much selectivity to the receiver or transmitter except at the intended notch. In other words, a band–reject duplexer is a poor choice as a solution for intermod.

Other Devices

A circulator is normally a three port device composed of ferrite material, magnets, and lengths of transmission line, that functions as a directional rf valve. Referring to Fig. 8a, rf entering port 1 comes out port 2, not port 3. Rf entering port 2 comes out port 3, not port 1, etc.

An isolator is a circulator with a dummy load connected to one port. As shown in Fig. 8b, it passes rf energy in one direction but not the reverse. Although the isolator can help correct transmitter intermod problems, it is not a preferred weapon due to its frequency and SWR sensitivity, its generation of harmonics, and a price tag of several hundred dollars.

The hybrid coupler or combiner is used the same as a TV 2–set coupler, to connect multiple transmitters or receivers to the same antenna and hence, has no value to this discussion of interference.

Repeaters

One of the basic requirements of a repeater system is to have sufficient signal isolation to prevent the transmitter from interfering with the receiver. Various techniques can be employed to provide this, including cavities, duplexers, separate antennas or separate sites for the transmitter and receiver, special shielding, etc.

Even though sufficient isolation may have been achieved to allow a repeater to repeat, a system often requires additional effort to eliminate intermod and other kinds of interference. Certainly, there is no cookbook approach to solving these problems and in reality, the solutions may be more numerous than the quantity of repeaters. Fig. 9 demonstrates cavity placement possibilities to enhance system performance.

Let's bring all this hypothetical interference into perspective by examining typical situations.

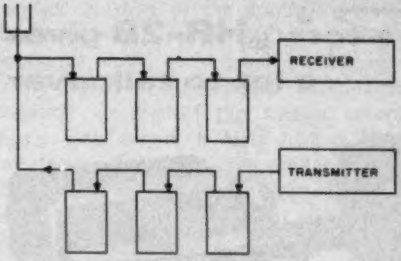

Fig. 6. Typical band–pass duplexer.

Problem: A 2 meter mobile transceiver experiences intermod from commercial two–way stations while operating in the downtown area of a city that has many high–power commercial stations. Other amateurs have the same problem using a variety of gear. However, there are some rigs that don't have the problem at all.

Solution: Many transceivers presently on the market have receiver intermod and desense problems when operated in the vicinity of transmitters who may be many MHz removed. Since some rigs don't have the problem in this example, we have enough information to conclude that the mixing is occurring in the transceiver indicating insufficient front–end selectivity for this environment. One cure is to add a band–pass filter or a wide–band band–pass cavity ahead of the receiver. Also, if a front–end transient protection diode is present, it should be placed after the tuned circuits rather than directly across the receiver antenna input.

Problem: A base station listening to weak stations on 146.52 or 146.85 or 146.94 MHz is overloaded with noise whenever a repeater, located about a half kilometer away, transmits on 146.76 MHz.

Solution: This could be caused by side-noise from the repeater transmitter or a deficiency in the base station receiver. It doesn't appear to be receiver desense but it could be poor receiver if selectivity. If any other receiver with comparable sensitivity and located as close or closer to the repeater does not experience the problem, then the fault is not due to noise from the repeater transmitter. To further diagnose the problem, a high Q band–pass cavity tuned to

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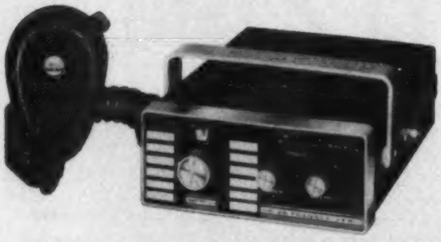

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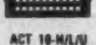

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146.52 MHz (the most distant frequency interferred with) could be inserted between the antenna and base receiver. Then, if the interference disappears on 146.52 MHz, the base receiver is at fault, not the repeater transmitter.

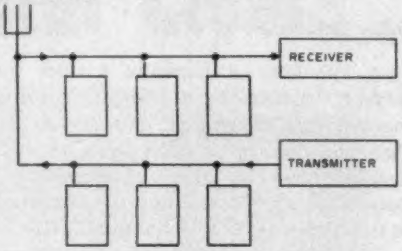

Fig. 7. Typic band-reject duplexer.

One method for attenuating transmitter side–band noise interference is to insert a band–pass cavity between the transmitter and antenna (before the duplexer, if one exists).

A band–reject cavity placed between the antenna and receiver could minimize desense and compensate for poor i–f selectivity response by notching out the repeater signal. However, a spacing of 200 kHz or more between the notch and the frequencies to be passed is required for optimum performance.

Problem: A repeater operating on 146.34 MHz input and 146.94 MHz output with separate antennas and no cavities experiences intermod that involves the 146.76 MHz output of another repeater located 1 kilometer away plus the 146.16 MHz output from a mobile station 3 kilometers away. The interference occurs only after the 34/94 repeater is keyed and then holds the repeater keyed until either of the other two signals cease.

Solution: Manipulating the numbers, we see that 146.94 plus 146.16 minus 146.76 equals 146.34 MHz. Since the three signal sources are so far apart geographically, they would be too weak to support transmitter intermod. Therefore, the fault is with the 34/94 repeater receiver. The cure is to minimize any of the three mixing signals before they enter the receiver input.

Actually, there are two problems illustrated by this example. First, the signal isolation between transmitter and receiver is inadequate as indicated from the involvement of the transmitter carrier frequency. Secondly, the receiver front-end selectivity is poor as indicated by the presence of the other two weaker signals. Both deficiencies could be compensated for by installing a band-pass cavity between the receiver and its antenna. Note that this problem could have occurred with any two external signals spaced 600 kHz apart.

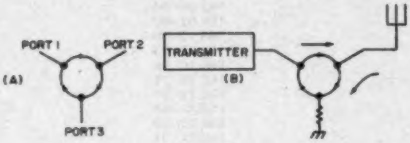

Fig. 8. (a) Circulator; (b) Isolator.

Problem: A repeater utilizing a band-reject duplexer is experiencing intermod interference that involves two or more external signals, one of which has been identified to be a commercial service transmitting 6 MHz higher and located700 meters away. The condition only occurs after the repeater is keyed and then the intermod holds the system keyed. The repeater antenna is located in close proximity to many other commercial transmitters that operate within the same band.

Solution: Not enough information has been supplied to prescribe a precise cure. We know that the repeater transmitter signal and the particular commercial signal plus one or more other external signals are involved in the mixing process butwe do not know where the mixing occurs. The problem could be in one of the nearby commercial transmitters or in the repeater transmitter or receiver in spite of the duplexer. A diagnostic approach to identify the offending apparatus would be to install a band-reject cavity between the repeater antenna and duplexer to remove the known external signal that occurs 6 MHz higher. If the intermod still persists, then probably one of the nearby commercial transmitters or some other external mixer is at fault and will need attention. In either case, this repeater may need a band-pass cavity permanently installed between the transmitter and the duplexer to protect the other nearby stations from noise and intermod since the band-reject type of duplexer is not intended to solve these types of problems.

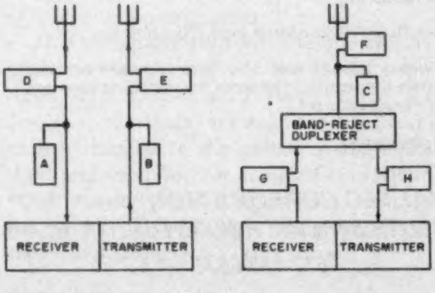

Fig. 9. Cavity placement possibilities in a repeater system. "F" is wideband.

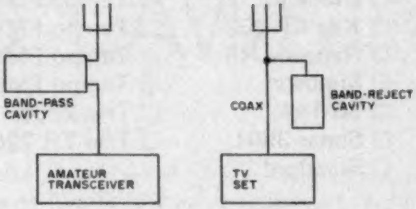

Fig. 10. Minimizing TVI.

Problem: A base station transmitter causes severe TVI. The amateur antenna is spaced only three feet from the TV antenna.

Solution: The cause is probably either transmitter spurious or too much signal for the TV system. Although your first thought might be to increase antenna separation, don't overlook the possibility of notching out the transmitter signal with a cavity in the TV transmission line. This is feasible only if the TV lead-in is coax and if there is no booster amplifier built into the TV antenna. In Fig. 10, transmitter spurious is minimized with a wide-band band-pass cavity and the transmitter signal is notched out of the TV system with a band-reject cavity.

In conclusion, let me emphasize that there is no single "best way" to cure an interference problem. A practical solution may actually be a compromise based on available resources and the depth of problem diagnosis.

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☐	146.31–91	☐
☐	146.34–94	☐
☐	146.37–97	☐
☐	146.40–147.00	☐
☐	146.52–52	☐
☐	146.94–94	☐
☐	147.00–00	☐
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SEXTON'S LAWS

For some time now, a concerned group of scientifically oriented radio amateurs has been studying the interrelations of the amateur and his technology. In the course of this study a wealth of statistical data has been reduced to a few simple equations which – for the first time in the sixty year history of amateur radio – allow the precise calculation of the effect of his hobby on the amateur.

Heretofore such calculations would have been impossible. However, with the publication of *Parksinson's Law*[1] and the recognition thereby that mathematical analysis of man in his environment was possible, it was only a matter of time until such analysis was extended to amateur radio.

In this dissertation no attempt will be made to use these newly discovered equations, now known as *Sexton's Laws*, for design applications. Instead, the discussion shall be limited to the nature of the equations and their use for analysis. It is left to other equally inspired amateurs to develop the forms of these laws which will allow their use in design.

Background

Our organization had first to determine the general nature of the ham-gear relationship. After initial debate, subcommittees were formed to study the question in depth.

At first we felt we would need to develop a mathematical model for the typical ham. This viewpoint, however, was soon dropped when we realized that we would be unable to develop a model that could encompass both SSB and CW operations. While one might think that the problem could be overcome by the use of separate models (that is, an S-parameter equivalent for the sideband ham and a T-parameter model for the CW-or telegraphy-operator) we felt it necessary to use a model that could account for the common origin of these widely different types. H-parameters were essential.

The problem of which direction our research should take was solved by the brilliant observation of one researcher. He stated that since most amateurs did not seem to be in control of their equipment normally, the obvious aspect to study would be the effect of equipment on the amateur.

This realization led to the formation of new study groups. These groups, after extensive debate (primarily on the proper semantics) determined that the three most important factors which affect the ham are the need for space, the financial involvement, and the frustration.

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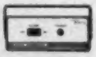
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With these factors to guide us, we were able to develop experiments and design computer aided statistical analyses of the results. We were then able to formulate the three laws of amateur radio discussed herein.

The First Law

No amateur ever has enough room and probably never will. Every ham will recognize the truth of that statement. Few, however, can accurately state how much room they need. Our research initially demonstrated that the required space is proportional to the square of the space available. The correct constant of proportionality eluded us until we realized that the required space would be determined by the activity of the amateur.

It is now possible to state that

$$S_R = KS_A^2 \qquad (1)$$

where

S_R = space required in m^3
S_A = space available in m^3
K = proportionality constant

The constant of proportionality can be calculated from

$$K = \frac{tn}{d} \qquad (2)$$

where

t = hours of operation per month
n = number of states countries worked
d = distance in miles to nearest electronic supply house

Critics of the First Law have objected that it is dimensionally inconsistent. That is, while one side of the equation must be expressed in units of volume, the other side of the equation has the apparently arbitrary units hrs-m^6/mile. Since the First Law deals, however, with the inconsistency existing between reality and the ideal in amateur radio, it follows that the First Law should be inconsistent. Furthermore, one must recall that higher mathematicians regularly deal with equations of inequality.

The constant "k" is called the *index of inconsistency*, or *Kennedy number*[2], and is explainable in that the more active the more room he needs – and the less likely he is to find it. That it is related to his proximity to parts houses may surprise some. We believe that the explanation for this lies in the fact that such establishments are usually a stimulus to amateur activity.

The amateur who attempts the use of the First Law should be aware that the *Kennedy number* can only be determined experimentally. This will require a considerable number of actual trips to parts houses to determine the nearest one, the shortest route to it and to average out such effects as earthquakes, the thermal coefficient of expansion for asphalt, etc. Indeed, the dedicated amateur will no doubt find a multitude of reasons for exhaustive experimentation in this area.

The Second Law

Every amateur will recognize that the larger a project, the more it will cost. However, beyond the usual claims that a project will cost only a few dollars and some parts that will be found in any junkbox (that they never are is a phenomenon now under study by our group), little is understood by most amateurs about cost projection.

Two general rules were developed to explain the equation which describes amateur project cost. First, even simple projects must be as complex as possible. No amateur can tolerate equipment that he cannot monitor and adjust. This characteristic (called the "bigger-and-better" syndrome by our psychological committee) usually requires that any project have at least one meter, one pilot light, a knob and a switch. More sophisticated hams often include several "screwdriver adjustments."

The second rule is that every amateur has construction quirks, or CQs, that profoundly influence the cost of his projects. These CQs may be readily determined by inspection. They usually take the form of a predilection for printed circuits, excessive metering, or an unexplainable preference for unnecessary and expensive components. As an example, one amateur we surveyed used 1% capacitors in his power supplies.

We are now able to state that

$$\frac{C}{C_O} = p \cdot \log\left(\frac{V}{V_O}\right) \qquad (3)$$

where

C = total cost of project
C_O = cost of smallest functional unit in shack
V = total volume of project
V_O = volume of smallest functional unit
p = adjustment factor

This relationship thus requires the determination of the smallest functional unit in the amateur's station, and its cost. One obvious disadvantage of the Second Law is that the amateur must have kept accurate records of the cost of all his projects to date. This is not often the case.

The factor *p* is apparently dependent on the nature and number of the constructional quirks – or CQs – associated with the amateur in question. It must be determined experimentally, since the CQs have so far defied analysis on our part. It is felt that if the CQs could be expressed numerically a relationship to *p* would soon be determined.

While it would seem that the Second Law is impossible to apply because of the unknowns, it is useful for cost estimation. Accurate determination of the unit cost may not be possible, but if the amateur will determine the number of Unit Volumes (UV) from v/v_O, a sufficiently accurate cost estimate for most projects may be obtained (in dollars) from

$$C = 20 \log (UV) \qquad (4)$$

The Third Law

The amateur's ability to obtain results in the face of any obstacle can be expressed by his *dedication index* or *Cooper number*[3] As with the CQs, this index is not possible to calculate. To complicate matters further it is apparently a variable function of at least four (and possibly more) parameters. However, most amateurs can expect that their *Cooper number* will decrease in the course of a project. Though the rate of change is not constant, when the index reaches unity, project activity ceases. The experienced amateur can usually estimate his time of duration on a project from its complexity.

An accurate estimate of the difficulty of obtaining satisfactory results from a circuit is possible if one can determine its stability. Most amateurs presently believe that circuit stability is deeply involved with circuit theory. Such analysis, however, only indicates that assuming *ideal* components, a circuit will or will not be stable.

It is our conclusion, however, that the only way to deal with circuits using *real* components, is through the determination of the probability of oscillation of a circuit. We found that this probability does not depend on the type of circuit, but only on the component count and component complexity. This is expressed by the Third Law as

$$P_O = 1 - \left(\frac{N_C}{N_l}\right)^2 \qquad (5)$$

where

P_O = probability of oscillation
N_C = number of components in circuit
N_l = total number of component leads

Obviously, equation 5 implies that anything with two or more leads has a better than even chance of oscillating. Theoreticians have criticised the Third Law on this point on the grounds that passive components, contrary to theory, may be able to oscillate.

One must, however, be aware that Sexton's Laws are applicable only to amateur radio. Furthermore, they were derived from statistical analysis of empirical observations and are not, therefore, based on theory. Thus, any criticism on theoretical grounds is unjustifiable.

Additionally, in the case of the Third Law, the results are an expression of probability. Anyone who has studied probability is well aware that the outcome of any event cannot be predicted from the probability of its occurence. Thus it is wrong to state that because something has a probability of ½, it must occur every other time.

Amateurs may use the Third Law to estimate the amount of time a project will require for debugging from

$$T \cong 100\, P_O T_O \qquad (6)$$

where T_O = time required to determine whether or not the project oscillated

The amateur may then compare this estimate to his estimated duration time. If experience shows that his actual debugging time greatly exceeds that predicted by the Third Law, he should not be alarmed. As every amateur knows, such projects are inherently unstable and therefore never to be entirely trusted anyway.

Conclusion

The laws of amateur radio, or Sexton's Laws, as described in this paper may be summarized thusly:

I. No amateur ever has enough space and never will.

II. The larger an amateur project, the more it will cost regardless of what it is.

III. If an amateur project works on the first try, it can't be very useful.

In application of the laws, as has been previously noted, considerable experimentation is necessary to achieve accurate results. The user should also be aware that the Heisenberg[4] principle of uncertainty is operative in all experiments dealing with these laws. This principle declares that the more closely one attempts to measure a phenomenon, the more one disturbs that phenomenon.

One might draw the conclusion that it must be impossible, under the constraint imposed by the Heisenberg principle, to obtain accurate results from Sexton's Laws. This is not so. The correct conclusion is that it is not possible to obtain accurate results from any finite set of measurements. Thus, the amateur is justified in making continual experiments.

Though controversy may arise concerning these laws, this final thought may convince even the most hardened doubter. Careful examination shows that the laws require that an amateur's station can never be complete. Is there anywhere a true amateur who can honestly say that he cannot meet that requirement?

. . .WB6CHQ

Footnotes

1. Parkinson's Law, C. Northcote Parkinson, Doubleday, New York, 1956.
2. The Kennedy Number is named for a certain amateur famed in certain circles for inconsistencies in equipment and apparent power.
3. The Cooper Number commemorates the occasion on which a dedicated amateur actually risked imprisonment for operating on 6 in a channel 2 fringe area. That this occurred in the middle of the 56 sunspot cycle should only inspire us all.
4. Physics of the Atom, M. Russell Wehr and James A. Richards, Jr., Addison-Wesley Publishing Company, Reading, Mass. 1960 p. 199.

CONSTANT CURRENT SOURCES

Larry Nickel K3VKC
216 Highmeadow Rd.
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Constant current sources are developing more and more uses today. Nickel cadmium batteries are current charged. Light emitting diodes are usually powered from current sources. Oscilloscope circuits use current sources charging a capacitor for generating the sweep. State of the art ICs can provide precise control of current.

The operational amplifier is an excellent current source provided a stable supply voltage is available. To understand the current source it is only necessary to know that an ideal op amp has infinite gain, infinite input impedance and its differential input voltage is equal to zero. This is not exactly true but practically speaking we can accept it as such. Refer to Fig. 1. Since the voltage at A is zero the voltage at B (and C) must be zero. No current flows from B to C. In other words, the output of the op amp reacts such that it keeps point C at zero. A constant voltage appears across R, and thus a constant current flow thru it (and Z) regardless of the value of Z. For instance if the supply is ±15V dc and R = 15KΩ then I = 1 mA. The current is constant within 1% or better as Z changes from 0 to 12KΩ or so. Naturally this circuit will work with any op amp.

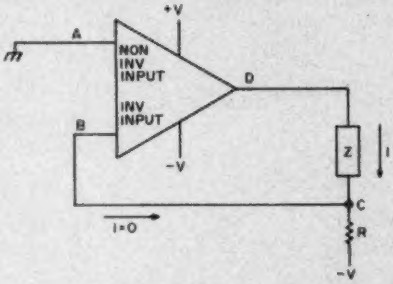

Fig. 1.

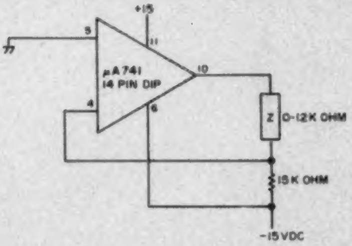

Fig. 2.

A µA709 could be used for instance but then frequency compensation capacitors would be needed. The µA741 has the additional advantage of being short circuit protected. To design for a particular current simply let R= V/I. Remember that V is the greatest amount of voltage available to produce current I thru Z. Note: The µA741 will handle up to approximately 25 mA.

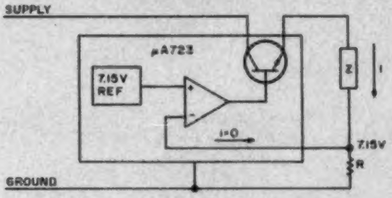

Fig. 3.

A more advanced current source employs a µA723 Fairchild voltage regulator. This circuit does not require a stable voltage supply. The IC has a built in 7.15V reference. Refer to Fig. 3. This simplified diagram shows how the IC acts to hold the voltage across R at 7.15V and thus cause a constant current flow thru Z. In Fig. 4, R = 15KΩ and I approximately equals .5 mA for Z from 0 to 50KΩ or more. Be careful not to use a supply voltage larger than 40V dc. This is maximum for the µA723. The performance of this circuit is excellent with current constant well within 1%.

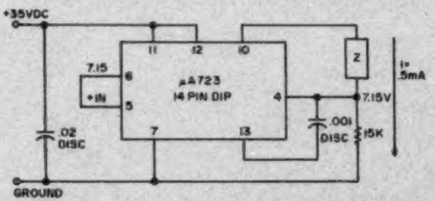

Fig. 4.

. . .K3VKC

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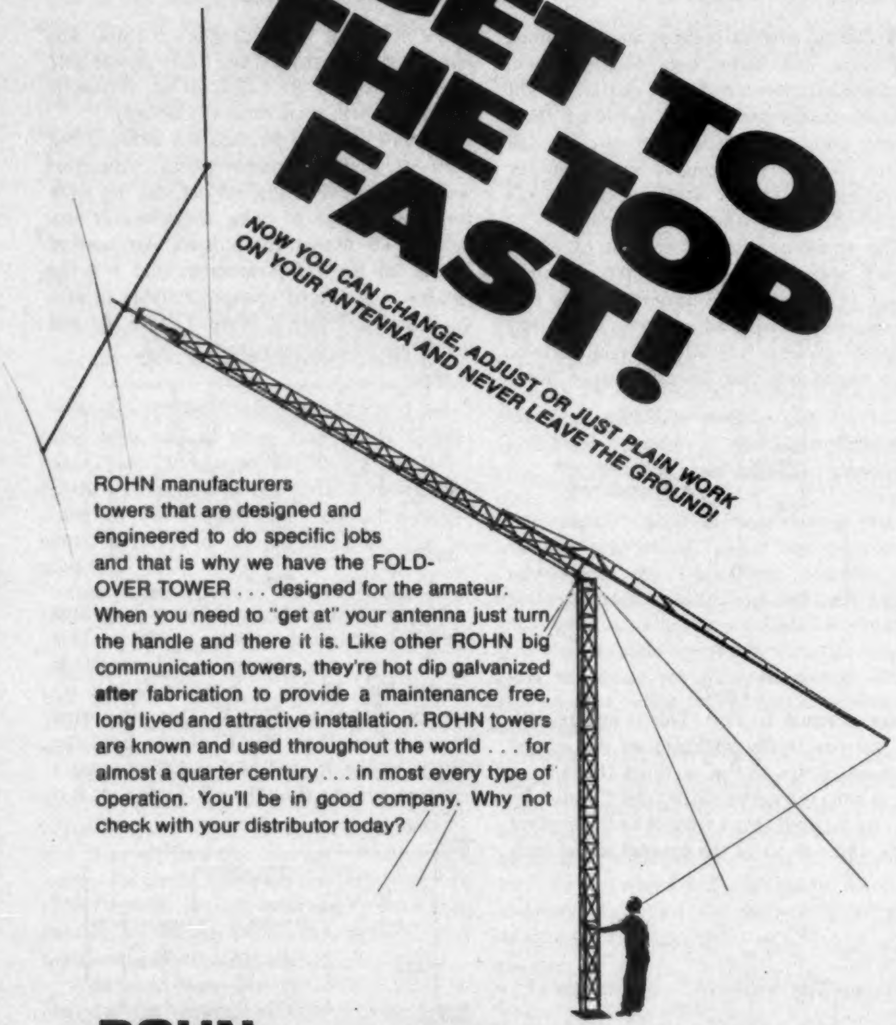

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EASY CALCULATIONS

Timing circuitry using RC circuits are found in a vast variety of applications. Multivibrators, some RC oscillators, electronic switches of various types and many other circuits depend on the state of charge of a capacitor to determine the rate or frequency at which events occur.

In such devices combinations of R and C are selected, usually so that the charge on the capacitor reaches a critical value (such as the cutoff bias for a particular tube) in the desired time after power is applied. In all such applications the time required to reach a selected voltage is a function of the capacity being charged or discharged, the resistance through which the charge or discharge current flows and the percentage of applied voltage selected as the critical voltage. Two formulas express the various relationships involved:

(1) $t = RC$

(2) $VC = E (I - \Sigma^{-t} / RC)$

In these formulas t is time in seconds, R is resistance in Ohms, C is capacitance in Farads, E is applied Voltage in Volts, VC is the instantaneous voltage across the capacitor at time t and Σ is a mathematical constant, 2.718.

In the formula for instantaneous charge across C, it is noted that there are an infinite

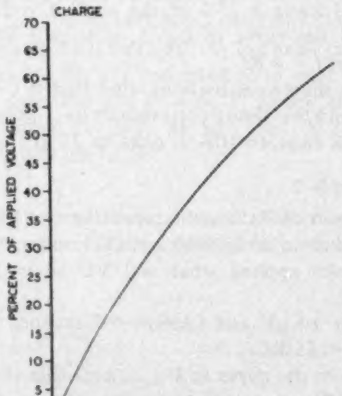


Fig. 1. Percentage of Charge vs. time to 1.0 RC.

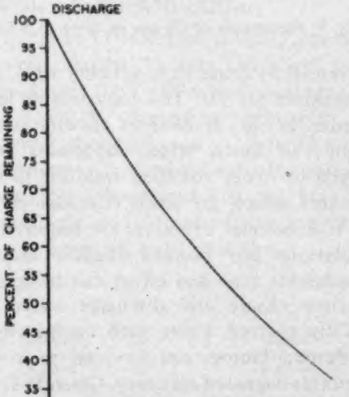
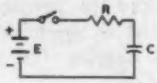


Fig. 2. Percentage of discharge vs. time to 1.0 RC.

number of combinations of R and C which will give the same arithmetical answer. Actual values chosen will depend on relative impedances within the particular circuit.

Generally speaking, in vacuum tube circuits the relatively high impedances have allowed the designer to work toward high voltages across comparatively small capacitances, resulting in time constants of one or more RC. In such instances calculations of VC are made quite simple since it is fairly easy to remember that in RC time the charge on the capacitor reaches 63% of the applied voltage. If the time constant is several times RC the charge reaches approximately the applied voltage.



$$V_C = E\left(1-\epsilon^{-t/RC}\right)$$

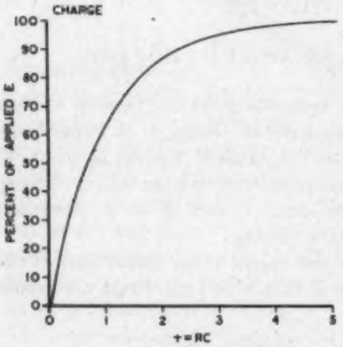


Fig. 3. Percentage of Charge vs. time to 5 RC.

Transistors cause us to actually work with the formula for VC. The considerably lower impedances in transistor circuits result, usually, in much larger capacitors being charged to lower voltages, resulting in time constants which are small fractions of one RC. If a number of values are required the calculations can become slightly tedious. Considerable time and effort can be saved if capacitor charge and discharge curves are carefully plotted. From such curves any of the desired factors can be read to a very acceptable degree of accuracy. Given R, C and E, VC (as a percent of E) can be read for any chosen time, or time (as an increment of RC) can be read for any desired percentage of the full charge.

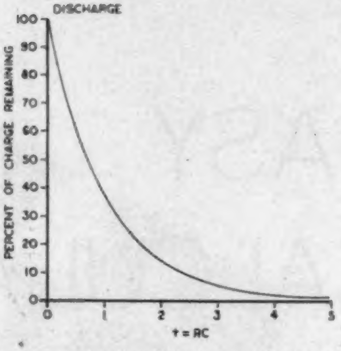


Fig. 4. Percentage of discharge vs. time to 5 RC.

Figures 1 and 2 show percentages of full charge (to 63%) and discharge, plotted against time increments of .1 RC to a total of 1 RC. Figures 3 and 4 are charge and discharge curves to nearly 100% (at 5 x RC), plotted in increments of 1 RC. Figures 2 and 4, the discharge curves, may also be used to determine voltage VR across the charging resistor, and Figures 1 and 3 give VR during the discharge of the capacitor.

EXAMPLES

Example 1

Given a circuit with 10 volts applied to the capacitor through a 10K resistor, it is desired that the voltage across the capacitor reach 3.3 volts in 100 milliseconds. What size capacitor is required?

1. 3.3 volts is 33% of the applied voltage. From the curve in Fig. 1, note that VC = 33% at t = .4 RC.
2. By simple calculations, find that if t = .4 RC, and this figure corresponds to .1 second, with R equal to 10K, C must be 25 μF.

Example 2

Given an RC circuit consisting of a 10 μF capacitor in series with a 100K resistor, with 25 volts applied what will VC be in 550 msec?

1. For 10 μF and 100K, t = 1 second. 550 msec = .55 RC.
2. From the curve in Fig. 1, note that at .55 RC, VC equals 43+ percent of the applied voltage. Simple calculation gives you 10.75 volts across the capacitor.

. . .K6TXR

Bill Hoisington K1CLL
Far Over Farm
Peterborough NH 03458

THE WORLD OF X-BAND

Avalanche and Gunn diode oscillators for the 10,000 to 10,500 MHz ham band

Any amateur who reads at all about radio today has heard of "solid state devices." Beginning with transistors, which are now economical up through the S-Band, 1000 to 3000 MHz, devices are becoming available at prices which are really unbelievable. Like good UHF transistors for 39¢! And X-Band oscillator diodes for $5 to $10! Granted, for the ham, these prices are slightly projected as to quantity and date, but not so very far ahead! UHF transistors at 39¢, so why not X-Band oscillators for $7.50?

At present, X-Band tuners, that is, cute little coax cavities, .64cm I.D., complete with tuning plungers, are available at reasonable cost.

I will therefore describe X-Band oscillators using Avalanche and Gunn diodes, which can be made up, tested, tuned, and operated by amateurs.

The Avalanche Diode Oscillator

This clever little device is really operated as a subminiature "torture chamber" for a silicon diode. You put a little voltage, say 1½V, *carefully* through a resistor in the "forward" direction and it acts like any diode you may be familiar with. It conducts. Reverse the voltage and you get high impedance, and no current. There may be a few microamperes, but forget that.

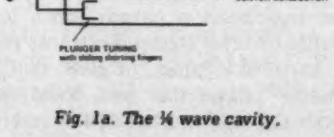


Fig. 1a. The ¼ wave cavity.

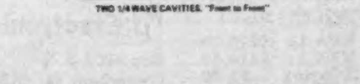


Fig. 1b. Two ¼ wave cavities, "Front to Front."

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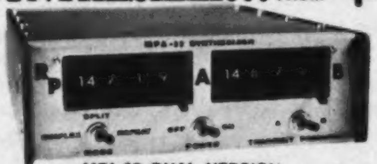

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Now for the "torture-chamber" bit. Applying more voltage in the reverse direction, that is, a lot more, like 50, 60, or 75V, (and don't forget that resistor!) you will reach "breakdown" and current now appears. This is when you get such a high electrical field across the diode junction that a "solid state spark" is now operating, electrons are traveling through the junction of the device at such a high rate of speed they knock out more electrons, etc. etc. This has been likened to an avalanche, hence the name. This is also the mechanism of a lightning stroke, which is also called avalanching. It is also somewhat similar to the gas tube device, only solid state, and the resemblance goes all the way back to the "Good Old Spark Days" of early amateurs. (I worked Chicago from New York with one myself, so enough of that laughter!)

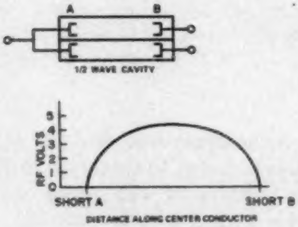

Fig. 1c. The ½ wave cavity.

This internal action creates a negative resistance, which is all you need for an oscillator device, and there you are. As this internal "spark" takes place, the voltage across the resonator (the rf cavity) drops, then builds up on the next half rf cycle, another surge of current occurs a tenth of a nanosecond later, and you're on the air at X-Band. Of course, as mentioned, *everything*, and I do mean everything, has to be right at X-Band, or no go.

The rf impedance (said to be near 1Ω!) is much lower than that of transistors, whose impedance is already much lower than that of tubes (remember, those funny large bottle-like things, of glass, that had "elements" inside that you could *see*?). This low impedance is handled by inserting

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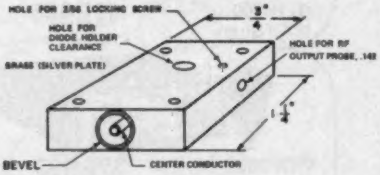
HOLE FOR 2/56 LOCKING SCREW
HOLE FOR DIODE HOLDER CLEARANCE
BRASS (SILVER PLATE)
3/4"
HOLE FOR RF OUTPUT PROBE, .142
1 1/4"
BEVEL
CENTER CONDUCTOR

Fig. 2a. Main body of the X-Band cavity.

the diode almost at the end of the half-wave resonator, close to one of the shorted ends. Do not let the idea of oscillations across a .64cm of brass bother you. It works!

How To Do It. Tuner Schematic

So much for the theory, now let's make it oscillate in the 10,000 to 10,500 MHz ham band.

Figure 1 shows the development of a half-wave cavity of the coaxial type, for X-Band, first with one quarter-wave, then with two quarter-waves "front to front," and then with the two together forming a half-wave unit. This has great advantages over the quarter-wave cavities in Q and also in the resistance to loading. This loading business is simply the shortening of a quarter-wave line, or rod, or center conductor of a coax cavity, etc., when a device is connected to it. It will pay you at this point to get a 10¢ ruler at the Five and Dime store. Be sure and get the plastic kind that has millimeters and centimeters along one side and inches along the other. You will find them readily displayed in front of you the wavelength of, for example, S-Band at 3000 MHz or 10 centimeters; C-Band at 5000 MHz or 6 centimeters; C-Band at 6000 MHz or 5 centimeters, and X-Band at 10,000 MHz or 3 centimeters. This latter is of course also 30 millimeters, which is easier to work with. The actual use of this little ruler as a wavemeter is described later.

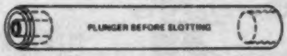

Fig. 2b. Tuning plunger before cutting the fingers.

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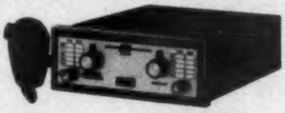

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GLH-100
P.A./Siren
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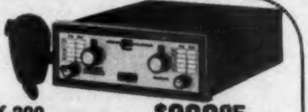

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As you will see, the quarter wave at X-band is getting pretty short; in fact on that little 10¢ wavemeter it is only 7½ millimeters, which is close to 5/16 in.

So how can you hook up a "device" to such a tuner? It isn't easy, as many high-priced microwave engineers have found out! But with a half-wave resonator it can be done, and have some tuning available as well. One I have here tunes from 9000 to 12,000 MHz.

Mechanical Details

Figure 2 shows you how to go about it. It is possible to make these pieces of hardware yourself, but I advise you not to unless you're a good man at a good lathe.

There is a good rule to follow at X-Band, "everything must be just so" or it won't work. The cavity must be good, the device good, each of the fingers of the sliding shorts must be making good contact, the output probe must be loosely coupled, at least to start with, etc.

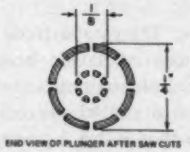

Fig. 2c. Plunger end view details.

The Cavity

The main body of the cavity, Fig. 2A, should be of brass, silver-plated inside and out. The .64cm hole is bevelled at the edges to allow insertion of the .64cm OD tuning plunger fingers, Fig. 2B, which are bent outwards to assure good contact with the inside of the ¼ in. ID cavity. The inner conductor is bevelled also, to allow the inner fingers of the tuning plunger to slip over it. These inner fingers are of course sprung inwards during fabrication to assure good contact during operation.

Tuning Plunger

The tuning plunger fingers, Fig. 2B, are of course very important. I have had some brand new ones (unfortunately not made of tempered beryllium copper) which were not too good, making and breaking contact as I moved the tuning plunger handle, with the oscillator going on and off. Then again I have a twenty-five year old World War II oscillator at 2000 MHz which had very springy silver-plated plunger fingers and still puts out 10W today!

Every finger of the plunger should make good contact!

In case you wish to try to make this item, here are the details. Figure 2B shows the .64cm rod with the .64 cm deep cut before the fingers are sawed out. The remaining walls should be as thin as possible for maximum springiness.

Figure 2C shows an end view of the plunger after using a fine jeweller's saw to cut out the fingers. Figure 2D shows a side view of the outside fingers only. The uncut portion of the plunger should be well under .64 cm in order to slide into the cavity without friction. It is drilled out in the center to over .32cm to allow it to slip over the center rod without friction.

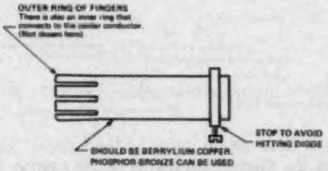
OUTER RING OF FINGERS
There is also an inner ring that connects to the center conductor. (Not shown here)
STOP TO AVOID HITTING DIODE
SHOULD BE BERRYLIUM COPPER. PHOSPHOR BRONZE CAN BE USED

Fig. 2d. Side view of the plunger.

The outer fingers are bent out to contact the cavity inner wall, and the inside fingers are bent inwards to contact the .32 cm inner rod.

The plunger body should be longer than the cavity in order to be able to tap the "no finger" end, and insert a screw for a tuning handle to push the plunger in and out. A stop should be provided to avoid going too far with the fingers into the cavity and hitting the diode.

Center Conductor

This piece is based on .64cm stock, brass or copper, or it can be turned down from

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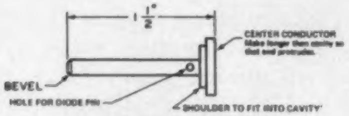
1 1/2"
CENTER CONDUCTOR
Make longer than cavity so that end protrudes.
BEVEL
HOLE FOR DIODE PIN
SHOULDER TO FIT INTO CAVITY

Fig. 2e. Center conductor of the cavity.

larger stock, again, if you are a good man on a good lathe. Having its end bevelled and protruding from the open end of the cavity body makes it easier to insert the plunger over this center rod and into the cavity without bending the fingers out of contact.

It should be silver plated also, and have a hole for the diode pin. This hole should be positioned so the large flange on the diode does not quite touch the disk on the end of the center rod. See also Fig. 4.

Rf Output Probe

The rf output probe is made up of semi-rigid coax of about .141 OD (one hundred and forty-one mils). Cut off about .64cm of the outer conductor with a jeweller's saw. Then cut off all but about 1.6 cm. of the insulation now exposed. (See Fig. 2F.) Solder a copper tab onto the center conductor and trim it to a shade less than .141 so that it can be easily inserted into the rf probe hole in the thick side of the cavity. Note that two walls of the cavity are thick, to allow for probe cable holding and locking with a 2/56 set screw. The other two walls of the cavity are very thin, for rf reasons outlined below.

X-Band Capacitor

A bypass capacitor for the ham X-Band cannot be purchased, as far as I know. But don't let that bother you, because you can make one yourself, as in Fig. 3A, if you pay attention to materials and shape. Shape at UHF frequencies and at X-Band is

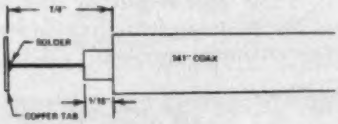

Fig. 2f. Rf output probe details.

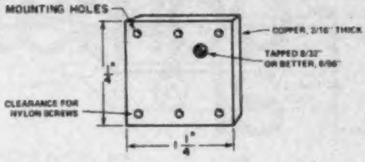

Fig. 3a. Details of the diode holder mount and bypass capacitor.

perhaps 90% of the battle. Look carefully at Fig. 4. One end of the diode makes contact with the center conductor, and the other end is held in the four teeth of the copper 8/32 diode holder. Note that the opening, which does not touch the diode, is in the thin wall of the cavity. The capacitor can be seen acting as part of, or a continuation of, this thin wall (through the 2 mil insulation) so that the end of the diode with its holder screwed tightly, but not tight enough to break the ceramic of the diode into the capacitor plate, is only a small fraction of a wavelength at X-Band from the cavity wall itself. The rf on the inner wall of the cavity should flow down the inner wall, across the capacitor, and onto the diode in what might be called a continuous fashion. If this is done correctly no rf will be found on the outside of the capacitor plate, and the dc connection may be made directly to the *outside* of the plate without choke coil or other bypass. The capacity of this item may be anything, as long as it is *over* some 50 pF.

The insulation may be mica, good clear grade, or fiberglass sheet, and should be around 2 to 3 mils thick. If thicker, the bypass action will suffer, and if less, there is risk of dust puncture and voltage breakdown.

Needless to say, clean everything well. All burrs and metal particles should be removed, and both surfaces should be polished flat with crocus cloth. And don't forget those nylon bolts!

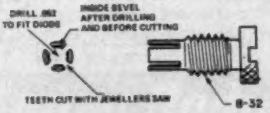
DRILL .062 TO FIT DIODE
INSIDE BEVEL AFTER DRILLING AND BEFORE CUTTING
TEETH CUT WITH JEWELLERS SAW
8-32

Fig. 3b. The diode holder is a modified machine screw.

Some More Mechanical Details

Referring again to Fig. 3A, four nylon bolts should be used to fasten this item to the main cavity body. After careful insertion of the diode and its holder, to position the plate on the cavity, mark two holes first and drill through the cavity. When bolted, mark and drill the other two holes. Of course if you are a super-machinist, do them all at once. Remember, the diode or it's holder must *not* touch the cavity body. If it does, the capacitor is shorted and there will be no dc on the diode. Provide a small soldering lug under one of the nylon bolts for the dc connection, and two mounting holes out on the side as shown in Figs. 5A and 5B.

Diode Holder

The diode holder is of course important. Remember that copper conducts heat some four times better than brass, and that heat is a bulk effect, so provide thickness as well as surface. If you only want a few milliwatts of rf for a test oscillator or an LO (local oscillator), you need not worry too much about heat-sinking, but if you want to get toward 100 mW (*those* diodes cost more!) or over, pay attention to that heat! And get rid of it, via the copper diode holder, the copper capacitor plate, and a chassis plate or wall. Figure 5B shows an extra plate or wall for heat-sinking in case you have to isolate from ground, as perhaps in a car. Again this is only for power.

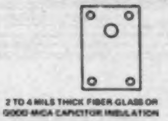
2 TO 4 MILS THICK FIBER-GLASS OR GOOD MICA CAPACITOR INSULATION

Fig. 3c. The bypass insulation should be fairly thin.

Some Mechanical Details

This is a small item, so do it right the first time. See Fig. 3B. Select a good clean 8/32 brass machine screw, or copper, if you're going for power. You may have to turn down a copper rod for this because copper machine screws are no longer found in every hardware store.

Check the diameter of the small end pin of the diode. The usual diameter is 1.6 cm. Drill out snug, bevel, and then make two or four saw cuts with a fine jeweller's saw. You might have to repeat, so get more than one screw on hand when you start. Clean very carefully and bend to hold the diode so that it can be inserted and taken out by hand.

Oscillator Assembly and Preliminary Tests

The whole unit, Fig. 4, after assembly and bolting together with the nylon screws, should be tested first for a capacitor short and then for diode conduction with an ohmmeter. With the avalanche diode inserted it should read low, around a few tens of ohms in the forward direction, and high in the reverse direction. Be sure the mica or fiberglass sheet extends beyond the copper capacitor plate so you see the sheet, and make sure that no metallic grains or dust come between the plate and the cavity body. Remember, there is only about two mils of thickness there, and this is easily punctured by metallic dust grains.

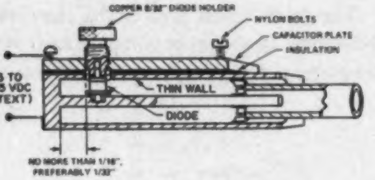
COPPER 8/32" DIODE HOLDER
NYLON BOLTS
CAPACITOR PLATE
INSULATION
75 TO 85 VDC (SEE TEXT)
THIN WALL
DIODE
NO MORE THAN 1/16", PREFERABLY 1/32"

Fig. 4. Cutaway view of the completed cavity.

Special Notice On Polarity and Heat-Sinking

This point should be planned ahead, as you will see. In general it is handy to have the cavity body at ground dc voltage because the rf output cable outer conductor will then be at dc ground also.

However, some diode manufacturers have the diode chip reversed in polarity from others. In 1968 most of them standardized on putting the main body of the chip in the *small* end of the double prong package. This is the end that must use the copper heat-sinking diode holder, so the polarity is thus determined, with the negative voltage on the heat-sink, putting the positive on the output cable. If you are using a 90V B battery it doesn't matter. If you are using a car battery and don't ground the antenna cable, still all right. However, some lab power supplies and some rf power meters use a common ground. Then it will matter.

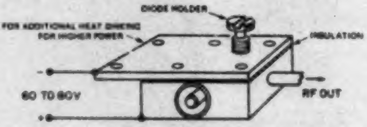
DIODE HOLDER
USE FOR ADDITIONAL HEAT SINKING FOR HIGHER POWER
INSULATION
60 TO 80V
RF OUT

Fig. 5a. Top view of the bypass capacitor.

Supply Voltage and Oscillation

You can use dry cells, such as two 45V batteries, or one 90V unit, with a variable resistor in series with perhaps a 1000Ω resistor (see also Figs. 5A and 5B). A transistor dc to dc converter or an ac supply may be used to get the voltage needed, which will be around 75V or so.

Always start in slowly with milliameter in series, and voltmeter across the *diode* connections, as in Fig. 5B. Later, when everything is tuned up okay, you can use a switch. At around 50–60V or so, depending on the diode, a few mils of current will start to flow, increasing as you turn up the voltage. At somewhere between 10 and 20 mA, again depending on the diode – and also on the oscillator circuit and rf loading

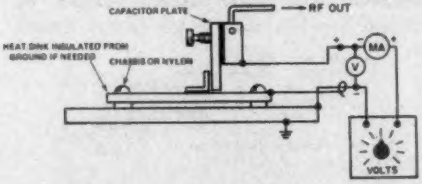
CAPACITOR PLATE
RF OUT
HEAT SINK INSULATED FROM GROUND IF NEEDED
CHASSIS OR NYLON
MA
V
VOLTS

Fig. 5b. Use a variable supply for the smoke test.

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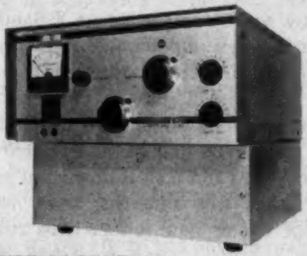

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The Tempo 6N2 meets the demand for a high power six meter and two meter power amplifier. Using a pair of Eimac 8874 tubes it provides 2000 watts PEP input on SSB and 1000 watts input on CW and FM. Completely self-contained in one small desk mount cabinet with internal solid state power supply, built in blower and RF relative power indicator. $695.00

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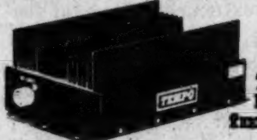

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TPL1002-3B	1-3W	80W	2M
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TPL802B	1 to 3W	80W	2M
TPL502	5 to 15W	35-55W	2M
TPL502B	1 to 3W	45W	2M
TPL252-A2	1W	25W	2M
TPL445-10	1 to 2.5W	12W	440MHz
TPL445-30	4W	30W	440MHz
TPL445-30B	1W	30W	440MHz

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of course – oscillations will start. Do not go over the manufacturer's rating for volts and mils (watts, that is).

Efficiency

Do not expect more than 1% or so in the efficiency department. For example, 75V at 20 mA equals 1500 mW of dc input power, and 15 mW of rf out! This is it!

Rf Out

So now you're on the air on X-Band. A simple off-center dipole and reflector is shown in Fig. 6A. This does radiate, after a fashion, and it will get you out into the room, anyway. Get some paraffin wax, like mother (or maybe grandmother!) used on top of jelly jars, and melt it down and pour yourself some lens antennas, using hemispheres of old or new rubber balls cut in half as molds. Start with a few centimeters in diameter, say one of 7.62 cm and one of 15.24 cm. Look out for fire with that hot wax! At X-Band a 43.18 cm lens has a theoretical gain of 33 dB, and I have one here that I measured at 29 dB gain. A lens antenna has the extremely important feature of producing, without scanning, either mechanical or electronic, an image on a microwave retina in back of the lens, allowing you to see through fog if you arrange things right! Most lens antennas as used for amateur work are sections of spheres, not parabolic.

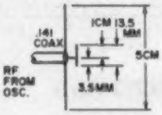

Fig. 6a. A simple dipole and reflector for X-Band.

Figure 6B shows a lens antenna assembly detail. Don't forget, *gain is equal to directivity*. This goes for any beam and all the other ham bands, too!

X-Band Detector

This of course can get to be a lengthy subject, so we will confine ourselves for the moment to a tried and proven design, now some 15 years old in my shack, which uses a 1N23 type cartridge, World War II type, which almost every ham has on hand. See Fig. 7A.

The small one and a .64cmdiameter lens was cast in a ping-pong ball and the shell left on. Cut .64 cm off the bottom and cement with more wax to the base plate. Figure 7B shows detailed dimensions, Fig. 7C has details of the brass block, and Fig. 7D shows a 12.7 cm lens detail.

I use this "space detector" in back of larger lenses, also. Dc will be found at the output terminals using a 50 μA meter, and also af providing the transmitter is modulated. This is another story, along with a good do-it-yourself superhet receiver using a high Q tuneable mixer cavity, for real DX work at 10,000 MHz!

Without amplification and using a 12.7 or 15.24 cm lens on the transmitter and another on the detector, you can expect meter movement around a table-top or the room, for some intriguing experiments, antenna tests, etc.

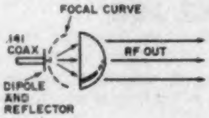

Fig. 6b. A high performance lens antenna assembly.

The 10¢ Wavemeter For Microwaves – It Works!

Practically every stationery store in the USA sells little plastic rulers with 150 millimeters on one edge. There is also a set of "natural numbers" that go as follows, for calculation of frequency vs. wavelength. Ones go with threes, fives with sixes, etc., so that 10,000 MHz equals 3 centimeters, or 30 millimeters, 3000 MHz equals 10 centimeters or 100 millimeters, 5000 MHz equals 6 cm, and 6000 MHz equals 5 cm.

This sort of thing is very useful at the amateur band of 10,000 MHz, where a half-wave can be seen directly on that little wavemeter as 15 millimeters, and the quarter-wave as 7½ mm.

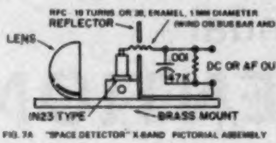
RFC - 10 TURNS OR 28, ENAMEL, 1 MM DIAMETER
REFLECTOR
(WIND ON BUS BAR AND SLIDE OFF)
LENS
.001
47K
DC OR AF OUT
IN23 TYPE
BRASS MOUNT
FIG. 7A "SPACE DETECTOR" X-BAND PICTORIAL ASSEMBLY

Fig. 7a. The space detector for X-Band.

Figure 8 shows an experimental setup for checking wavelength (frequency!). T transmits to R, registering perhaps half scale on the 50 μA meter, and ST, the semi-transparent movable SW indicator, is interposed. I have found .48 cm beaverboard with aluminum spray paint on one side, to work well for this X-Band "transparency." I just clamp a 15.24cm square in a small drill vise, tape the ruler to the table-top, and proceed. As some rf is reflected and some passes through ST, standing waves are created in the medium (air). On moving ST back and forth between T and R, a maximum will be found on the meter at every half wavelength. Take an average of several readings for security. For example, on the 10¢ millimeter ruler scale you find maximums (use minimums if you're contrary) at 45, 59, 65, and 81 millimeters. Add up the half-wave spacings thus found by moving the drill vise along the ruler, which are 14, 15, and 16 millimeters, divide by three for the average, and you get 15 millimeters. This is the half-wavelength, so multiply by two and you get a full wave of 30 millimeters. You are thus on the low edge of the 10,000 to 10,500 MHz ham band. So that's it for avalanche diodes. Have fun!

The Gunn Diodes

The Gunn diode comes in the same tiny package as the avalanche diode, but operates more like a true negative resistance device, showing this characteristic even at dc. It also takes less voltage, around 10 instead of 70 to 80, but the efficiency dc to rf is about the same, as the millliamps are now up around 100. It has advantages and disadvantages, compared to the avalanche diode. It is less noisy, making it more suitable for local oscillator service at X-Band, but, at least for the present, it costs more (as much as three times more) and does not have the rf output of the avalanche.

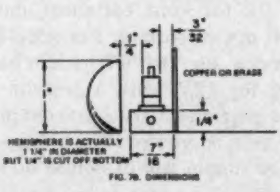
$\frac{1}{4}$"
$\frac{3}{32}$"
1"
COPPER OR BRASS
1/4"
HEMISPHERE IS ACTUALLY 1 1/4" IN DIAMETER BUT 1/4" IS CUT OFF BOTTOM
$\frac{7}{16}$"
FIG. 7B. DIMENSIONS

Fig. 7b. Dimensions of the X-Band detector.

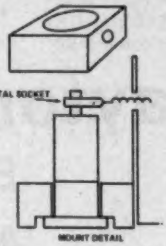
CLIP FROM OLD OCTAL SOCKET
MOUNT DETAIL

Fig. 7c. Brass mount for the 1N23 diode.

The rf impedance of these Gunn diodes is higher than the avalanche diode, near 10Ω according to some "informed sources."

At any rate, it will operate at a point nearer the center of the center conductor of the X-Band cavity. This point is detailed in Fig. 9. Aside from that point and the dc voltage, other considerations previously considered for the avalanche diode can be the same.

Voltage Supply For The Gunn Diode

As mentioned, this is a nice feature of the Gunn. You start in, using a variable

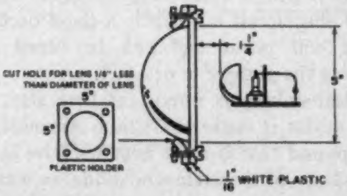
CUT HOLE FOR LENS 1/4" LESS THAN DIAMETER OF LENS
5"
5"
PLASTIC HOLDER
$1\frac{1}{4}$"
5"
$\frac{1}{16}$" WHITE PLASTIC

Fig. 7d. Detail of the large lens.

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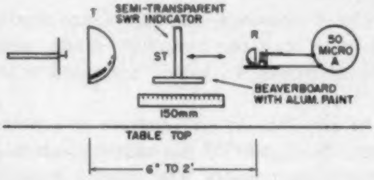

Fig. 8. Setup for checking wavelength.

12V (maximum) supply and the mils will climb to over 100, and then suddenly drop to a lower figure, say around 80 mA. This is because of the dc negative resistance action. It does not necessarily mean that the diode is oscillating, but this is the place where it will, if everything is okay rf-wise!

If the circuit is correct, X-Band oscillations will occur and can be tuned by moving the plunger in or out.

Heat-sinking is important here also, as this device is made of Gallium Arsenide, a compound that is more heat sensitive than the silicon of the avalanche diode, so watch the temperature when operating continuously. Incidentally, cooling the oscillator to below zero sometimes boosts the power by a factor of as much as two.

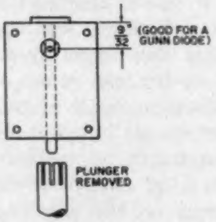

Fig. 9. Cavity modification for a Gunn diode.

For a light, hand-carried rig, seven type C flashlight batteries provide a nice operating voltage for most Gunns, dropping to 10V (maybe 9½ for some batteries) under the near 100 mA of current. For good continuous service, use two 6V lantern batteries in series for 12V, with a resistor. These batteries generally carry a maximum rating of 5 00 mils, so you're all set. A good low voltage ac supply will of course do fine on the bench.

. . . KICLL

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AN IC MIKE PREAMP THAT DOUBLES AS A TONE GENERATOR

The integrated circuit operational amplifier has finally come of age. The variety of IC op amps now available to the designer and experimenter is finally allowing for real design flexibility. Dual op amps, FET input op amps, high slew-rate op amps, and micropower op amps are now readily available. Also, the "general purpose" IC op amps like the 709 and 741 have become quite inexpensive (in the $1.00 to $2.00/each price category for single quantities).

The preamp herein described is built around one of the new dual op amps that is available in the "half-DIP" form – a dual-inline package with only eight pins. The Signetics N5558V is only $2.00 in single quantities, making its internal op amps $1.00 apiece. The Signetics N5558V is also available from Motorola as the MC1458CP2, from National Semiconductor as the LM1458, and from Texas Instruments as the SN72558P. The price of the competitor's types will probably be similar to that of the Signetics N5558V.

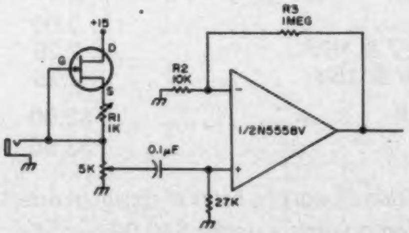
+15
D
G
S
R1
1K
5K
R2
10K
R3
1MEG
0.1μF
1/2N5558V
27K

Fig. 1. Carbon mike preamp (equivalent circuit).

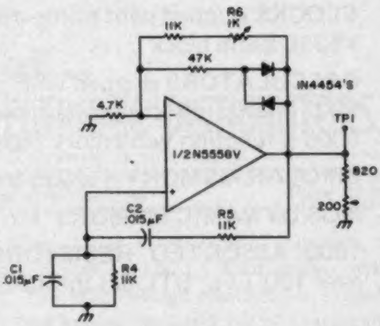
R6
1K
11K
47K
1N4454'S
4.7K
TP1
1/2N5558V
820
200
C2
.015μF
R5
11K
C1
.015μF
R4
11K

Fig. 2. Test tone generator (equivalent circuit).

The first half of the N5558V is used as a gain stage to increase the voltage level of the output of the carbon mike-current source combination, or as a Wien Bridge oscillator.

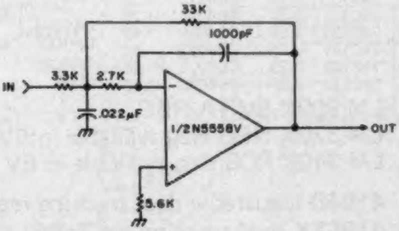
33K
1000pF
IN
3.3K
2.7K
.022μF
1/2N5558V
OUT
5.6K

Fig. 3. Active low pass filter.

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74C04	.85	CD4001	.60	LM372	1.25	
74C10	.60	CD4002	.60	LM374	2.00	
74C20	.60	CD4009	1.00	LM382	1.75	
74C73	1.65	CD4010	1.00	555	1.00	
74C74	1.25	CD4011	.60	556	1.60	
74C76	1.75	CD4012	.60	741T	.45	
74C107	1.75	CD4013	1.25	741 Mini	.45	10/3.95
74C151	3.30	CD4016	1.25	CA3028	.75	
74C160	3.25	CD4019	1.45	CA3065	.75	
74C161	3.25	CD4023	.60	CA3086	.45	
74C162	3.25	CD4025	.60	5558	1.00	
74C163	3.25	CD4035	3.10			

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Whether this stage performs as an audio amplifier or an audio oscillator depends on which way S1 is thrown. With S1 in the "mike" position, the equivalent circuit is as shown in Fig. 1. Note that we use an FET here as a constant-current source; the constant current through the variable resistance of the carbon mike provides an audio voltage. The amount of constant current is adjustable by means of R1; it is variable from the I(dss) of the FET to some lower value. In a typical case, I(dss) was 7.6 mA and the amount of constant current was variable from 7.6 mA to 1.6 mA. As with most FET's, the I(dss) of the HEP 802 has a rather loose spec (2–20 mA). The gain of the first op amp as an amplifier is set by the ratio of R3 to R2: 1 Meg/10K = 100.

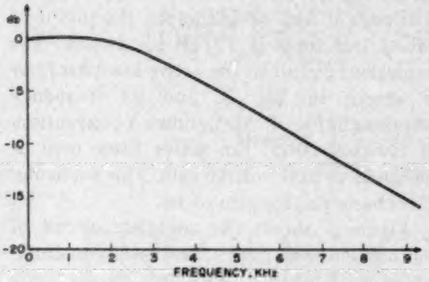

Fig. 4. Frequency response of active low-pass filter.

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When S1 is in the "tone" position, the first op amp becomes a Wien Bridge oscillator. The Wien Bridge oscillator is probably the best known oscillator for generating pure sine waves; it is the form used in most laboratory audio generators. Although this circuit is rather a simplified one of the Wien

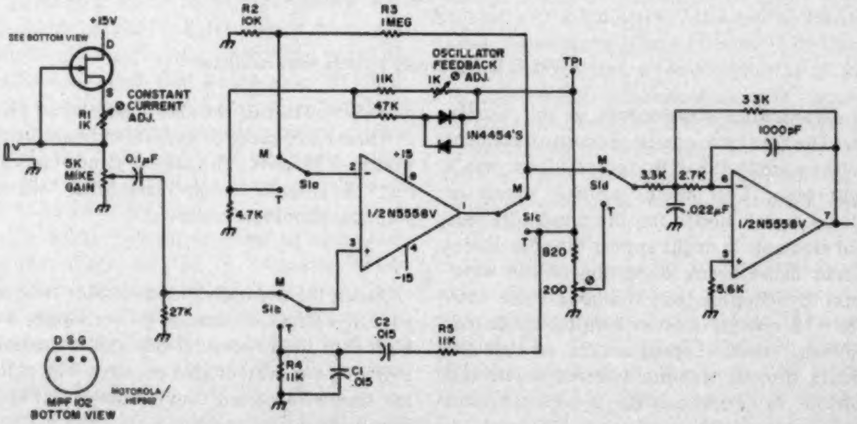
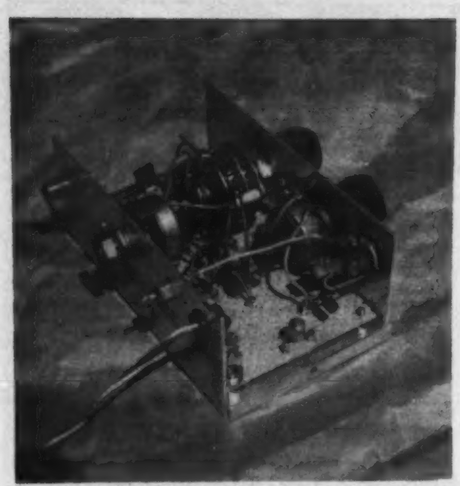

SEE BOTTOM VIEW
+15V
D
S
R1
1K
CONSTANT
CURRENT
ADJ.
5K
MIKE
GAIN
0.1μF
27K
D S G
MPF 102
BOTTOM VIEW
MOTOROLA/
HEP802
R2
10K
R3
1MEG
M
S1a
T
4.7K
M
S1b
T
R4
11K
C1
.015
C2
.015
R5
11K
OSCILLATOR
FEEDBACK
ADJ.
11K
1K
47K
1N4454'S
+15
8
2
3
4
-15
1
1/2N5558V
M
TP1
S1c
T
820
200
M
S1d
T
3.3K
2.7K
.022μF
3.3K
1000pF
6
5
7
1/2N5558V
5.6K

Fig. 5. Combination preamp and tone generator.



Topside view of the inside of the IC Mike Preamp.

Bridge, it is capable of producing a sine wave whose largest harmonic component (the 3rd harmonic) is more than 50 dB down from the fundamental. The capacitors C1 and C2 and the resistors R4 and R5 are the frequency-determining components in this oscillator. The feedback non-linear control element in the classic Wien Bridge oscillator was a light bulb. This circuit utilizes a pair of silicon signal diodes for the non-linear control element. It might appear that the diodes would cause severe distortion of the waveform by clipping, but this is not the case. The 47K resistor in series with the diode pair "softens" their clipping action, so that the diodes provide stability without severe distortion. In operation, R6 is adjusted until the output of the oscillator is 10V peak-to-peak (at T.P. 1).

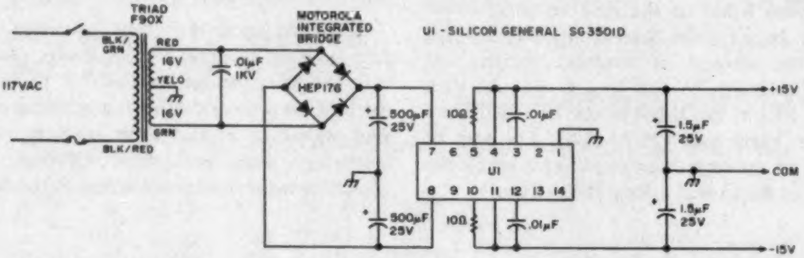


Fig. 6. Power supply for sine wave oscillator.

Regardless of whether the first op amp is used as a mike preamp or as an audio tone generator, the second op amp always functions as an active low-pass filter. The cutoff frequency of this filter is set at 3.3 kHz. Although it uses no inductors, the rolloff of this active filter is 12 dB per octave. The equivalent circuit of the active low-pass filter is shown in Fig. 3, and its frequency response in Fig. 4. Also, unlike a conventional low-pass filter, the active filter may be designed to have voltage gain. This particular filter has a voltage gain of 10.

Figure 5 shows the complete circuit of the preamp-tone generator. It was constructed in an LMB No. 136 box chassis, as a subassembly of a larger SSB system. The unit used conventional- sized pots and switches, and could have been made considerably smaller if miniature types had been substituted. Note that the wire exiting through the rear of the box through a 1000 pF feedthrough capacitor is simply the connection to the "tip" of the PL68/U style jack (going to the mike button for control purposes). Most of the circuit was wired on a 2-7/8 x 4-3/4 piece of multihole board using Vector T28 pins. The layout is not critical, but high-gain audio amplifier wiring practices should be observed.

Since the preamp tone generator is to be part of a larger system, no power supply was built into it. However, if this unit is the only part of your system that requires ±15 volts, the simple regulated supply shown in Fig. 6 is quite adequate to operate it.

. . .W6GXN

Robert M. Harkey W4CUG
3234A Hamilton Street
Hill AFB UT 84406

INCREASED SPEED FOR THE K2OAW FREQUENCY COUNTER

Beginning in the May 1972 issue of *73*, K2OAW presented a very complete series of articles on the construction of a frequency counter with a low frequency (0–20 MHz) input and a divide-by-10 prescaler capable of extending the upper frequency limit to 300 MHz. The counter appeared to be just what I needed. In fact I wrote to K2OAW and he generously forwarded a copy of the circuit board layout in advance of publication of the next article in *73*. The counter was built using mostly surplus ICs and junk box parts, and worked the first time it was plugged in. By sorting the ICs according to speed, I was able to obtain a stable upper frequency limit of 32 MHz in the low frequency position. I have not yet added the prescaler ICs since I had no immediate need for VHF capability, but extension of the low frequency limit did intrigue me – especially since I had heard of Heathkit counters that would go to 40 MHz. Much experimentation was accomplished on the front end of the counter, including the 40673, the 7413 and the 7400 input selector. Maximum attainable speed remained in the 32 to 34 MHz range.

The main problem appeared to stem from the limited speed of the 7473 flip-flop which comprises the divide-by-two function of the first decade. Simultaneously with my discovery of the apparent problem with the 7473, low cost Schotty TTL ICs became available from some of the surplus companies. (They are available from Solid State Systems, P.O. Box 773, Columbia MO 65201.) A 74S73 flip-flop was obtained and plugged into the IC5 position on the circuit board and things started to happen. Using a four turn wire loop on the counter input and a grid dip oscillator as a signal source, the counter's upper limit was found to be 62 MHz! To say the least, I was flabbergasted. Subsequent checks proved that the initial test was not a fluke and the counter was now stable from 20 Hz (the lower limit of my test equipment) to better than 60 MHz.

The next limiting factor on the upper frequency limit appears either to be the 7413 Schmitt trigger or the divide-by-five function of the 7490 in the first decade. Further experimentation is under way on replacement of the 7490 with a 74196 or some other high speed device. I'm also hopeful that a Schottky 7413 will be introduced. However, a friend of mine (1Lt Dan Wright) has operated a 74S00 Schottky IC in a Schmitt trigger configuration with operating limits in excess of 100 MHz and maybe this setup can be used to replace the 7413. Anyway, there are tremendous possibilities and, who knows, maybe I'll never install the 95H90 prescaler.

My sincere thanks to friends who have added ideas and provided encouragement to my experimentation. They include 1Lt Dan Wright, 1Lt Cecil Lockett and 1Lt Bruce McIntire. Most of all, thanks to Pete Stark K2OAW, for his design and article on the counter.

. . .W4CUG

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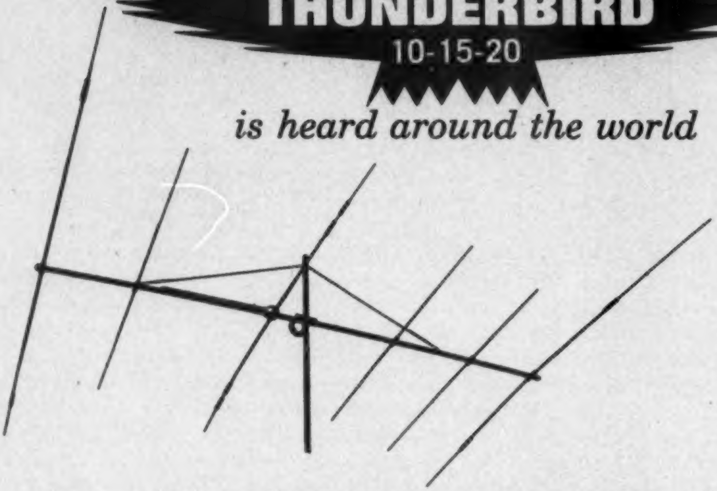

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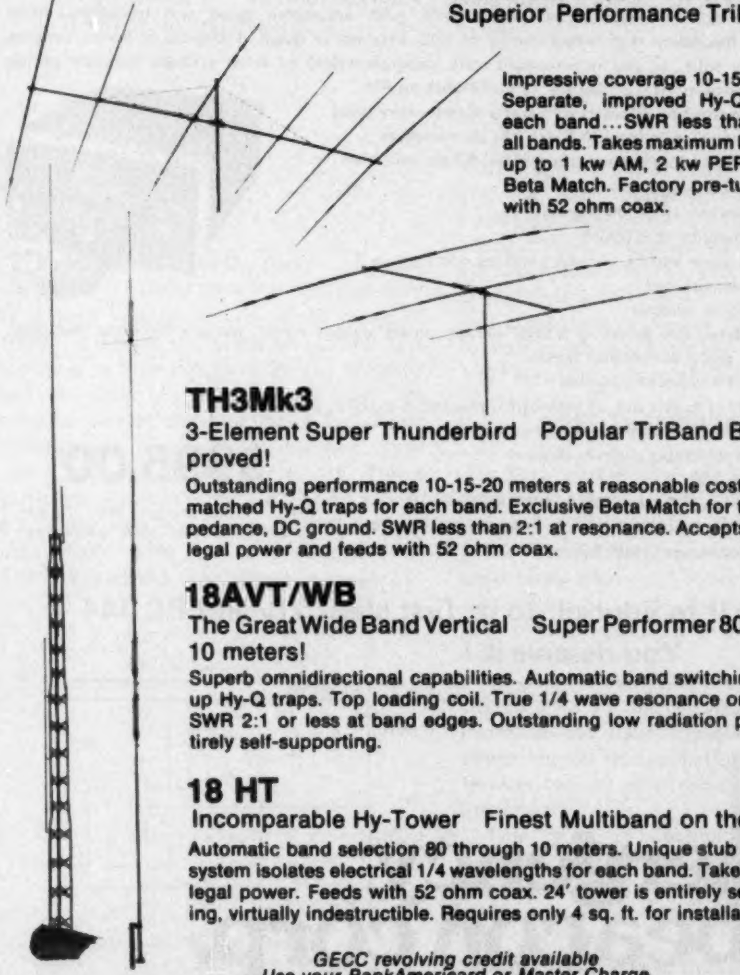

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ABI NOTES

Ten tips for the homebrewer who seeks homebrew answers to those homebrew problems.

CHEAP POWER SUPPLY FOR A CRT

Recently, while in the process of building a small monitor scope, I had need of a high voltage source in the range of 1000V. I found the available transformers too large or too expensive for the project I had in mind. As is often the case, the solution was in the junkbox. I found two transformers of the "TV booster" type which provided slightly over 1000V. This is sufficient for most 5.08, 7.62, and 13.7 cm. CRTs. By now you are wondering how to get 1000V from two transformers with 125V secondaries. The answer is simple. T1 is hooked up in the normal manner, primary to 117V ac and the 6.3V winding to the CRT heater. The 6.3V winding of T2 is used as a primary and is connected in parallel with the CRT heater. The normal primary and the high voltage secondary plus the remaining winding of T1 are phased series aiding. These windings in series produce approximately 367V ac which is doubled by D1-D2 and C1-C2. A CRT requires only a few microamperes, so the filter will charge to very nearly peak or 367 x 2.8 or about 1027V dc. Try it, it works beautifully.

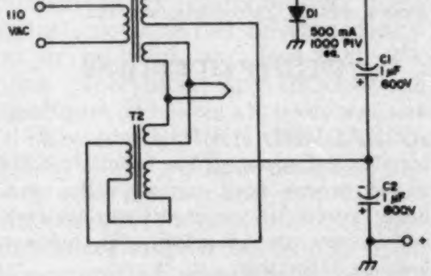


Fig. 1. CRT power supply.

FREE TRANSFORMERS

I have seen several articles on the fine points of obtaining parts from defunct TVs. These all follow the time honored course of power transformers, controls and other obvious parts. I have yet to see mentioned the possibilities in audio output transformers and vertical oscillator and output transformers.

As you may know, the vertical deflection circuits of a TV operate at 60 Hz, is it not logical to put these transformers to use in power line 60 Hz applications? Audio transformers too are adaptable to the same type operation.

One word of caution: Many vertical output transformers are actually autotransformers and as such should not be used without isolation between it and the power line.

After removal from the chassis, determine what you have by checking the windings with an ohmeter, then apply line voltage to the high resistance winding and measure the secondary voltage. Record the ratio (110:5.5

etc.) and the lead configuration on the transformer and file for future reference. A rough estimate of the current capability may be made by comparison to known transformers.

In order to illustrate the uses to which these transformers may be put, I will give some examples from my own experience.

1. Ratio 110:1.8 isolated vertical output, used with a voltage doubler to supply power to a transistorized frequency standard.
2. Ratio 110:10 isolated vertical output, used as source for a home brew "high intensity" light.
3. Ratio 110:4.6 autotransformer vertical output, used to furnish bias in a transceiver power supply. Low voltage side connected to one half of the filament transformer secondary.
4. Ratio 110:12 isolated audio output, used as filament supply for a two tube amplifier.
5. Ratio 110:26 isolated vertical oscillator, rectified and used to supply 28V dc to two surplus coax relays.

These are just a few of the many uses to which these free transformers may be put.

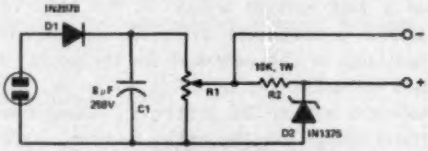
EXPANDED RANGE LINE VOLTAGE METER

An expanded range meter, as you are no doubt aware, magnifies a selected segment of voltages so that readings may be taken with greater accuracy and fluctuations will cover a greater percentage of the meter arc, making them more easily detectable. On a typical VOM, such as the Simpson model 260, 5V on the 250V range covers one scale division; with this adaptor the same 5V is spread over 5 divisions, making the reading of one volt simple and .1V not impossible.

The principle involved is quite simple. The line voltage is applied to D1, the resulting dc is filtered by C1, which charges to peak. Resistor R1 is a voltage divider which delivers the equivalent of the rms voltage to D2, a 100V zener diode, through current limiting resistor R2. Under 100V, insufficient voltage is developed between the slider of R1 and common to allow D2 to conduct, therefore no voltage is developed across R2. As the applied voltage is increased, D2 conducts and regulates at 100V. Any voltage in excess of 100 is developed across R2. Any voltmeter of 1000Ω per volt or more may be used to read this voltage.

This gadget is installed in a minibox with a line cord attached for connection to the ac line and tip jacks for the external meter. If desired, a larger case could be used and a meter and multiplier resistor permanently installed.

Calibration is simple. Measure the ac line with a meter of known accuracy, then adjust R1 to produce this reading minus 100 on a low dc scale of your external meter. The line voltage will be the meter reading plus 100V. In the case of very low line voltage, a low scale may be used. For example: 105V would give a center scale reading on the 10V scale. If the line voltage exceeds 110V it will be necessary to switch to the 25V range on the external meter.



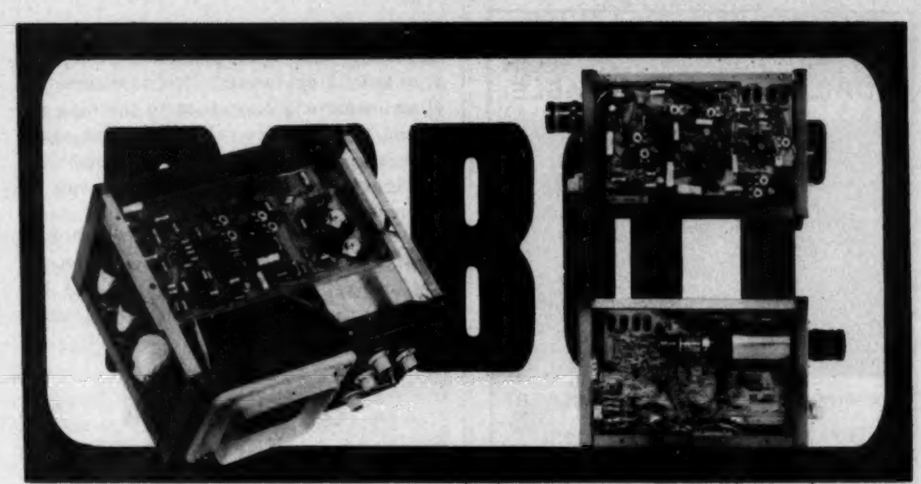
R1 = 15K, 5W WIREWOUND POTENTIOMETER

I bought all parts for this project from a mail order house at a cost of less than $3. While this unit doesn't have the absolute accuracy of some commercial units, it will prove very useful in checking for overloaded wiring, and insufficient voltage to linears, motors, air-conditioners, etc.

SPEED UP KIT BUILDING

As a new owner of a piece of kit equipment, you are naturally in rather a hurry to get it together and operating. The building process is bad enough alone, but when the usual hectic search for the proper part for each construction step is added, the torment becomes unbearable.

One easy way to save time when building a kit is to sort out all small components into their respective types and values before beginning. Not an unusual idea, you say? Correct, but here is a twist: Stick each group of identical parts to a section of wide



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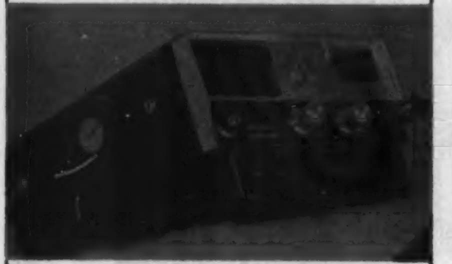

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Parts which come packed in see-through bags with an identification number on the bag are best left in the bag and the bag stapled to a sheet of paper with other similar parts.

LOW COST CAPACITOR COVERS

More often than not the high voltage supply for a modern transceiver or linear uses several capacitors in series, all capacitor cans, except the one at the cold end, above ground. This is an inexpensive way of eliminating bulky high voltage capacitors. Home brew design has followed suit to a large extent.

There is a distinct disadvantage to having the capacitor cans above ground. The cans are hot electrically and present a serious safety hazard if not covered in some manner. Having built a 3000 volt power supply and not desiring to build a metal cage, I consulted catalogs in hopes of finding an inexpensive Kraft paper tube of the type so often seen in TVs. No luck, not only were they expensive, but they didn't come in the required length.

Why not cut lengths of cardboard tube from that most noble of paper products? Because it's too large, that's why. But there are ways around that, and besides we need protection on the top of the can anyway. How about painting the tube flat black to obscure its ancestry, slipping it over the capacitor and sealing it in place and covering the top with silicone rubber (black if possible). It works fine and costs almost nothing.

POTENTIOMETER REPAIR

Any carbon control which is adjusted often or which is subjected to dc flow will soon become erratic in operation and require replacement. I was recently faced with this problem in conjunction with a small imported AM/FM radio which I keep on a bedside table. The volume control is hardly ever advanced past the point at which the switch closes and for this reason that portion of the element became so erratic it was not usable.

A replacement control was not immediately available, so other steps were required. My solution to this problem was to insert a fixed resistor of approximately 10% of the potentiometer value in series with the control. The added resistance is not enough to upset the circuit requirements, but it is enough to change the operating point to a virgin portion of the element.

This simple remedy would work as well in a carrier null circuit, a microphone gain control circuit, or anywhere this problem is experienced. Not only is the relatively high cost of the pot saved, but also the inconvenience of obtaining and installing it.

CUSTOM LOG PAGES

It seems as though every time the subject comes up someone in the group will comment about his lack of appreciation of the various commercial efforts at producing a log. Two of the most frequent complaints are the lack of space for comments and the multiple columns provided for data the operator couldn't care less about. Obviously no one log form can please everyone, so why not design a log to your own liking and in line with the type of operating you do. There is nothing sacred about a commercially printed log – all you need to do is provide the data required by the FCC. I suspect the back of an aluminum siding circular would be acceptable as long as you follow the rules and regulations as set forth in 97.103.

Decide for yourself what you want, then have a hundred or so copies mimeographed by your local business service. The last time I had this done it cost 3¢ each. If you have access to duplicating equipment this is just that much more frosting on the cake.

My own preference runs to a rather simple form with separate logs for each

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RF TOROIDS 12/$1.00

A homebrewer seeing the above heading in a parts catalog would probably order at least a dozen on general principles. The quality is excellent, the item is useful, and the price is right.

There was a need for a toroidal core for a miniature vfo and not having one available, catalogs were consulted in the hope of finding an inexpensive source of supply. Having seen a reference to using ferrite slugs for this purpose, the search was centered on this item. The chosen supplier (on the basis of price) advertised standard ¾ in. square, double tuned, 10.7 MHz transformers at 3 for a dollar. Each transformer has two slugs of ferrite of a rather odd shape. The exact upper frequency limits of these slugs is unknown. Catalog listings of "red" cores (to which it is assumed these are similar) indicate a range of .5 to 30 MHz. The outside of the slug is threaded and screws down over the outside of the coil, while one end features a recess which allows the center to fit inside the coil.

After the slug is removed from the transformer and clamped gently in a vise it is an easy matter to hacksaw it into two pieces of equal thickness. One of these pieces will be a ready-made toroid measuring 9/16 in. O.D. x about 3/16 in. thick, and ready to wind after a little filing to remove burrs and round edges which might cut through the winding insulation. Three transformers have thus far yielded six ready-to-use cores and six discs of ferrite. These discs are now drilled in the center with a small bit, 1/8 in. is large enough. This serves as a pilot hole for enlarging the center to a usable size. The actual hole may be made in several ways, the most rapid of which is a 5/16 in. round rotary file in a high speed hand grinder. A hand reamer may be used, though it requires more care. File as before, and you have six more cores for your dollar.

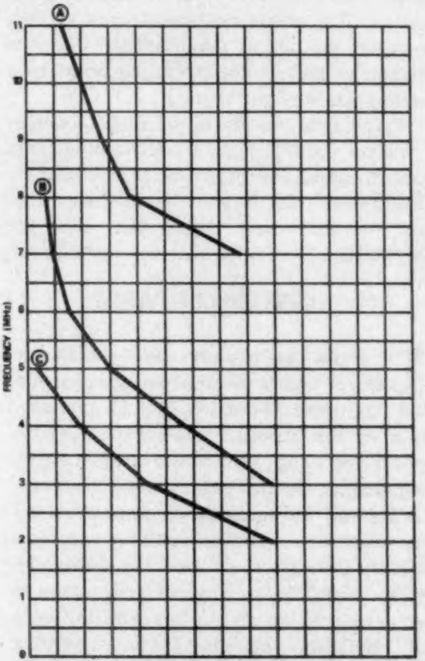

Fig. 1. Graph of capacitance vs. frequency for three different windings. (A) = 30 turns, no. 18, (B) = 36 turns, no. 24, and (C) = 65 turns, no. 28.

While it is best to exercise caution so as not to fracture the ferrite when sawing or drilling, no great harm will be done if one should break. A drop or two of epoxy will repair it without impairing its electrical characteristics.

No research has been done on the subject, but it would seem reasonable that similarly shaped cores from transformers made for other frequencies would work equally well, assuming the intended operating frequency is not too far removed from that for which the core was originally intended.

Leave several inches of lead at each end of the winding and use these as a link for coupling to a grid dip meter after installation in your equipment. Without this link it is impossible to get a dip due to the magnetic field being contained almost entirely within the core. After dipping to frequency, cut the leads short and install as usual.

QUICK CRYSTAL CHECKER

What does one do with an unmarked or questionable crystal? You could try it in several different types of oscillators to determine if it would oscillate. An all band receiver would tell you the approximate frequency of oscillation if you don't mind tuning carefully and bandswitching a few times.

A simpler way is to make the crystal think it is a filter (which it is) and sweep the spectrum until you find a frequency which the crystal will pass. The usual shop type signal generator and a vtvm or wideband scope are all that are needed. The generator ground is connected to the indicating device ground and the crystal connected in series with the hot leads. Tune the generator rapidly while watching the meter or scope for an increase in amplitude. At the first sign of a flicker, peak the generator and read the frequency. Obviously this is not of frequency meter accuracy but then again a crystal frequency is determined to some extent by the circuit in which it is used and for this reason it is impossible to get an absolute frequency check without using the crystal in the circuit and under the ambient conditions of voltage and temperature. Also obvious is the fact that the measurement can't be more accurate than the generator used.

Fundamental crystals of up to 12 MHz have been checked in this way with complete success. Overtone crystals have been checked too, but due to response limitations of the scope it was possible to check their fundamental frequency only. The scope used is down 3 db at 4.5MHz.

In summation, the above will tell you if a crystal is active and get you in the ballpark frequency wise in a lot less time than any other method. P.S. it works with LC circuits too.

INCREASE YOUR GRID DIPPER RANGE

There is general agreement that a grid dip meter is an invaluable piece of amateur test equipment. Why then cofine its use to the usual frequency range of 2 or 3 MHz to perhaps 250 MHz when it is easy to make additional coils to cover the lower ranges.

Browsing through the catalogs will quickly convince you that hardly anyone sees fit to supply low frequency coils and when they do it is at additional cost. Why not make your own?

All you need is a base that will fit the coil socket of your dipper, a coil form or two, and a little patience. My current dipper is a Heath GD-1 (which I find superior to several others I have had around the shack) which requires a two pin coil base. In my case I had only to bend two lengths of copper tubing to the proper spacing for the coil terminals at one end and the socket spacing at the other. After the proper frequency range was established, the entire coil and about a half inch of the leads were potted in casting plastic, making a very sturdy assembly.

The low cost coils I used (5¢ each) came equipped with a ferrite slug. I left the slug in for the lowest range – 250 kHz to 1 MHz and took it out for the higher range – 1 MHz to 2 MHz. No exact data can be given due to the variation in dipper circuitry. This will be a case of pure "cut and try." The range of the new coils must be plotted on a graph against the original dial markings.

A general coverage receiver will allow calibration down to 550 kHz and by feeding the signal into its i-f strip, an additional point at approximately 450 kHz is obtained. Below that frequency things get a little tougher. If you happen to have a low frequency receiver, fine, if not, use harmonics in the BC band.

. . .WA0ABI

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7404	.25	7453	.22	74145	1.25
7405	.27	7454	.45	74150	1.25
7406	.55	7460	.22	74151	1.05
7407	.55	7460	.30	74153	1.45
7408	.25	7461	.30	74154	1.75
7409	.25	7464	.45	74155	1.25
7410	.25	7465	.45	74156	1.50
7411	.35	7470	.50	74157	1.50
7413	.85	7472	.45	74161	1.05
7414	.80	7473	.55	74163	1.50
7416	.50	7474	.55	74164	2.05
7417	.50	7475	.55	74165	2.05
7420	.25	7476	.55	74166	1.65
7421	.33	7478	.50	74173	1.50
7422	.33	7483	1.25	74175	1.65
7423	.37	7485	1.20	74176	.95
7425	.38	7486	.65	74177	.95
7426	.35	7489	3.25	74180	1.15
7427	.38	7490	1.25	74181	4.25
7430	.25	7491	1.40	74182	1.10
7432	.35	7492	1.05	74190	1.65
7437	.50	7493	1.05	74192	1.65
7438	.55	7494	1.10	74193	1.65
7440	.25	7495	1.05	74194	1.65
7441	1.25	7496	1.05	74195	1.15
7442	1.15	74100	1.05	74196	1.35
7443	1.25	74105	.55	74197	1.15
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74H04	.45	74H40	.40	74H72	.60
74H08	.45	74H50	.45	74H74	.70
74H10	.40	74H53	.47	74H76	.70
74H20	.40	74H55	.47		

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8091	.60	8214	1.95	8590	1.15
8092	.60	8219	1.95	8810	.95
[illegible]	.60	8220	1.85	8812	1.25
[illegible]	.60	8230	2.95	8822	2.95
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8122	1.05	8290	1.05	8831	2.95
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A SIX METER TRANSCEIVER

from a used CB rig

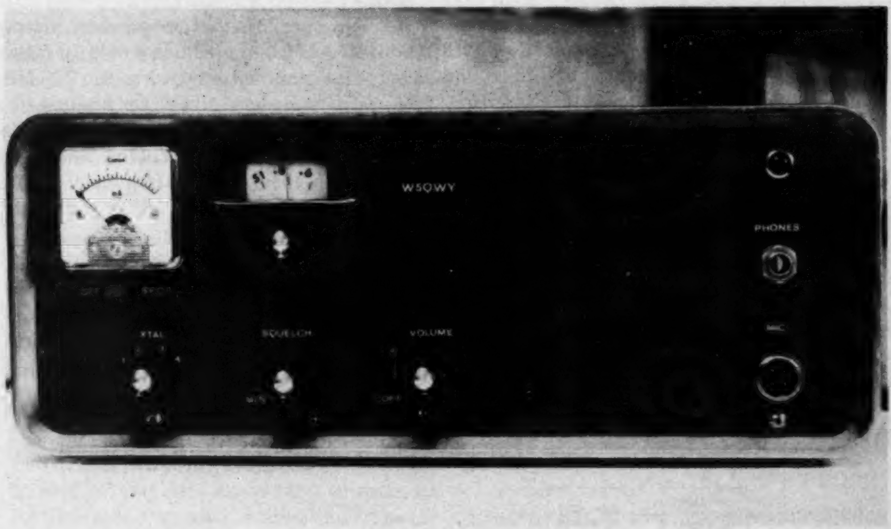
The manufacturers of CB transceivers have been flooding the market for years and as a result have created a mecca of used gear that can be bought for a song. The radio amateur, with a little innovation, imagination and bench work can easily convert these CB transceivers into six meter rigs that will give a good account of themselves by anybody's standards.

Interested? Well, here is one way to do it!

I chose as a guinea pig the Lafayette Comstat 19 – first because it is a simple rig and second it is cheap.

Figure 1A is a block diagram of the Comstat 19 and attests to its simplicity. The receiver section consists of a 6BZ6 rf amplifier, 6GH8 oscillator/mixer, 6BJ6 455 kHz i-f amplifier, 6T8 detector and first audio amplifier and a 6AQ5 as audio output. The 6AQ5 also serves as the modulator when transmitting.

The receiver oscillator frequency is determined either by the main tuning capacitor or by a crystal, whichever mode is selected. The receiver oscillator tunes 455 kHz below the



W5QWY's converted Comstat 19.

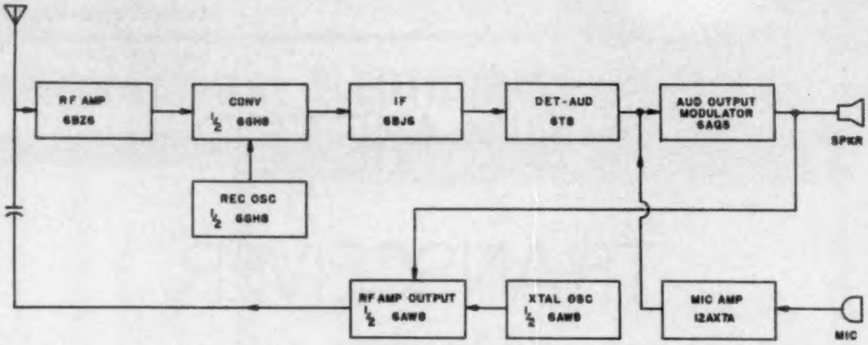

RF AMP
6BZ6
CONV
½ 6GH8
IF
6BJ6
DET-AUD
6T8
AUD OUTPUT
MODULATOR
6AQ5
SPKR
REC OSC
½ 6GH8
RF AMP OUTPUT
½ 6AW8
XTAL OSC
½ 6AW8
MIC AMP
12AX7A
MIC

Fig. 1A. Original circuit.

incoming signal to produce the 455 kHz i-f. There is provision to select up to nine receive and transmit crystal frequencies.

The transmitter consists of the triode section of a 6AW8 as an overtone crystal oscillator followed by the pentode section as an rf amplifier. The microphone output is amplified by the 12AX7 and modulates the pentode section of the 6AW8 thru the 6AQ5. Note that no antenna relay is used. The antenna is connected to both the receiver rf amplifier and transmitter rf output at the same time.

As I said before, this is a simple and cheap but salvageable CB transceiver. On more expensive units you can expect to find such improvements as double conversion, multiple i-f stages or a higher (1650 kHz) i-f frequency, more crystal positions and relay send/receive control to name a few.

Generally speaking, the more of these improvements the basic CB transceiver has, the easier the conversion job. For instance if the CB transceiver has either a 1650 kHz i-f or is double conversion then it will only be necessary to add a conversion stage to take the 50 MHz signal down to the 27 MHz CB frequency and to convert the transmitter for 50 MHz output.

Comstat 19 Modification

The big drawback with the Comstat 19 is the single i-f stage operating at 455 kHz which gives poor image rejection even at CB frequencies. The first conversion attempt consisted of merely adding a 6U8 50 MHz rf amplifier and mixer down to 27 MHz. However the image signal was about half as strong as the primary signal. Such performance was totally unacceptable and it was decided to change the i-f frequency to 1650

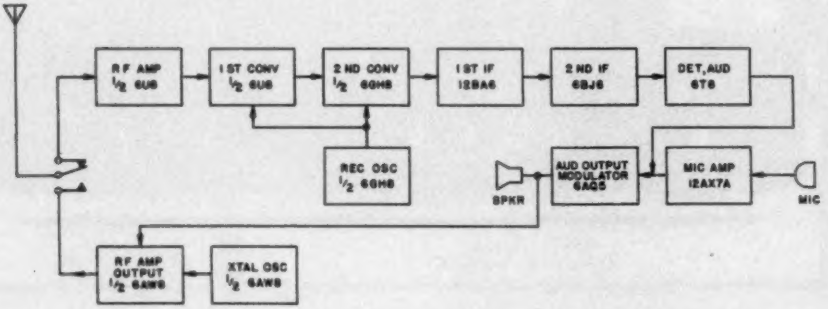
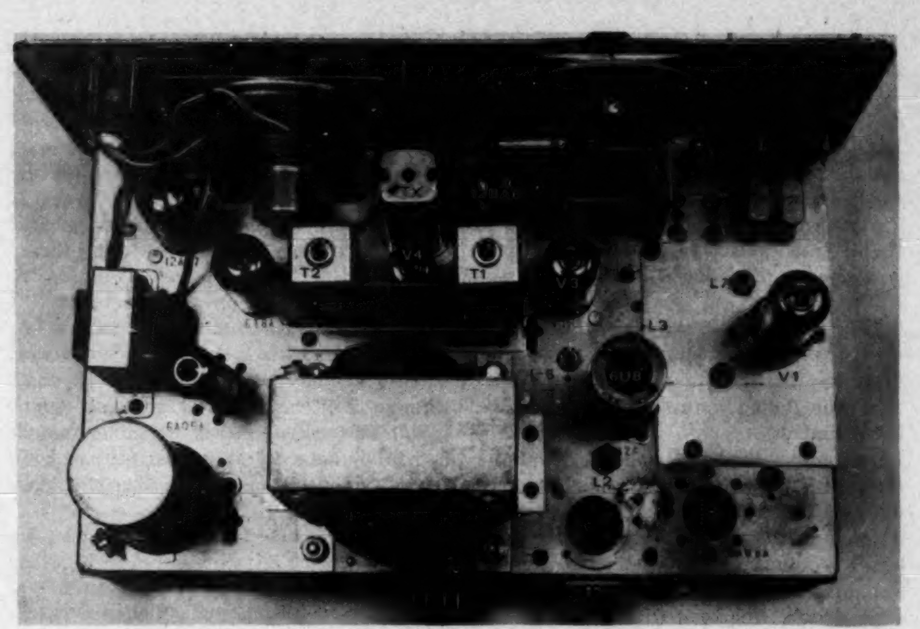

RF AMP
½ 6U8
1 ST CONV
½ 6U8
2 ND CONV
½ 6GH8
1 ST IF
12BA6
2 ND IF
6BJ6
DET,AUD
6T8
REC OSC
½ 6GH8
SPKR
AUD OUTPUT
MODULATOR
6AQ5
MIC AMP
12AX7A
MIC
RF AMP
OUTPUT
½ 6AW8
XTAL OSC
½ 6AW8

Fig. 1B. Modified circuit.



Top chassis view. Note the locations of the additional i-f stage 12BA6 and transformer TX. The 6AW8 was relocated on an aluminum plate in the upper right corner of the chassis where the original array of receive/transmit crystal sockets and switch used to be.

kHz. This did the trick as the image was now barely perceptible.

Figure 1B is a block diagram of the converted Comstat 19. A 6U8 rf amplifier/mixer replaces the original 6BZ6. The input and output tuned circuits of the 6U8 are stagger tuned to give a flat response between 50.0 and 51.0 MHz. The output of the 6U8 converter is 25.825 MHz for a 50.0 MHz signal and 26.325 MHz for a 51.0 MHz signal. The 6GH8 injection oscillator tunes 24.175 to 24.675 MHz to produce an i-f frequency of 1650 kHz over the range of 50.0 to 51.0 MHz. Using a common injection oscillator for the first and second convertors eliminates the necessity of adding another tube. Note, however, that it only takes a swing of 500 kHz of the oscillator to tune 1 MHz of the six meter band.

Following the 6GH8 second converter are two 1650 kHz i-f amplifier stages. The 12BA6 i-f amplifier was added to make up for the gain lost when converting from the 455 kHz i-f frequency. The rest of the receiver section is left unchanged.

The transmitter lineup is basically the same, that is, an overtone oscillator (now operating at 50 MHz) followed by a rf amplifier. The location of the transmitter section was completely changed to accommodate shorter rf leads, better current paths, and make room for the transmit/receive relay and output tuned circuit.

Destruction

The first step in making the modification is the removal of parts or sections of the transceiver that will be changed. The following list will serve as a guide for component removals. However, it is recommended that the original wiring diagram that came with the transceiver as well as Figs. 2 and 3 be studied thoroughly to make sure you understand exactly what must be removed before beginning.

Save all the components that are removed as many of them will be reused.

Remove . . .

1. Both ends of all components mounted on the 6AW8 socket.
2. The 6AW8 socket.

3. The PI-output coil, capacitors and bracket.
4. The crystal selector switch and crystal socket assembly.
5. The wires to the front panel XTAL/TUNE switch.
6. The front panel crystal sockets.
7. Both ends of all components mounted on the 6BZ6 socket up to the 10 μF capacitor connected to pin 2 of the 6GH8.
8. The 6BZ6 socket.
9. All of the components in the receiver oscillator tuned circuit up to the 20 μF capacitor that goes to pin 9 of the 6GH8. The main tuning control "VCT" should be left mounted.
10. i-f transformers T1 and T2 should be removed and the inside form and windings discarded. The Miller transformers should be inserted into the original cans and these in turn remounted. The Miller transformers are just the right size, can and all, to fit into the original cans. For what it is worth this will provide double shielding on these two transformers.

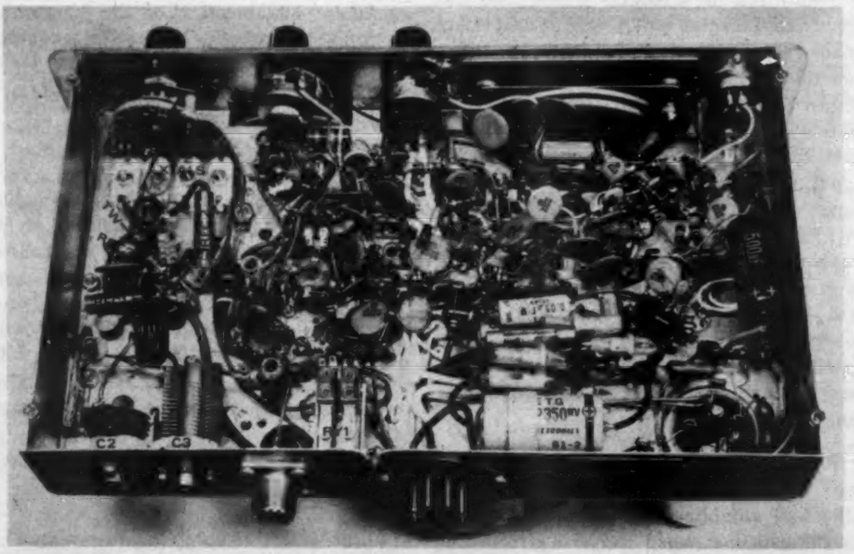
Construction – Receiver Section

Refer to the photographs to help identify the components and locations.

1. Enlarge the old 6BZ6 socket hole to accept a nine pin shield base socket for the 6U8. Orient the socket so that pins two and three are closest to the antenna coax socket. Drill holes to mount L2 and L3. L2 should be mounted close to pin 2 and L3 close to pin 8 of the 6U8.
2. Make sure all underchassis components are moved out of the way before doing these next steps.
3. Drill a hole for a 7 pin socket between T1 and the front panel for the 12BA6 first i-f amplifier.
4. Drill a hole for the additional i-f transformer "TX" between V4 and the front panel. This transformer is easiest mounted by drilling one large hole and using the special mounting plate supplied with the transformer.

Construction – Transmitter Section

1. Cut a piece of .16 cm thick aluminum to cover the rectangular space left from the removal of the crystal socket assembly. Mount the transmitter components on the plate as shown in the top view photograph. Holes are drilled in the plate to mount it to the chassis in the same position that was



Bottom chassis view. Note the locations of C2, C3, RY1 and RFC1, 2 & 3 that are grouped around the 6AW8 socket near the left end of the chassis.

used to mount the original crystal socket assembly.

2. Mount the output indicator meter on the front panel. When making the hole (where the old external receiver-transmitter sockets were mounted) make sure it is high enough to allow the slide switch to be reinstalled below the meter.

Wiring

The heater circuits should be the first circuits rewired. It's a lot easier to do before the bottom of the chassis gets cluttered with circuit components. The heater circuit shown in Fig. 2 should be followed closely since the original wiring did not fully agree with the diagram supplied with the set.

The original winding on L5, L6 and L7 must be removed and rewound per Figs. 2 and 3.

The dc power source parts for the send/receive relay are mounted on spare terminal strip lugs in the power supply section of the transceiver.

The converter oscillator injection signal is coupled to the 6U8 by soldering an insulated piece of hookup wire to pin 9 and twisting the other end several times around pin 2 of the 6GH8.

The 1 MΩ resistor in series with the spot switch limits the oscillator output preventing overloading the receiver while spotting. Diode D1 allows voltage to be applied to the oscillator but not the amplifier while spotting.

The only real important thing to keep in mind while doing the wiring is to keep all rf leads and bypass leads as short as possible.

Note that the secondary of T1 which was originally wired to V4 is rewired to the new first i-f amplifier – the 12BA6.

Operation

Since most of the six meter activity in this area is confined to the first 1MHz of the band and since only the receiver oscillator is tuned it was decided to limit the tuning range from 50.0 to 51.0 MHz.

T1, TX, and T2 are tuned for maximum response at the i-f frequency. L2, L3 and L5 are tuned for maximum even response between 50.0 and 51.0 MHz. It was found that tuning L2 towards 50.0 MHz and L3 towards 51.0 MHz gave the best uniform-stable operation.

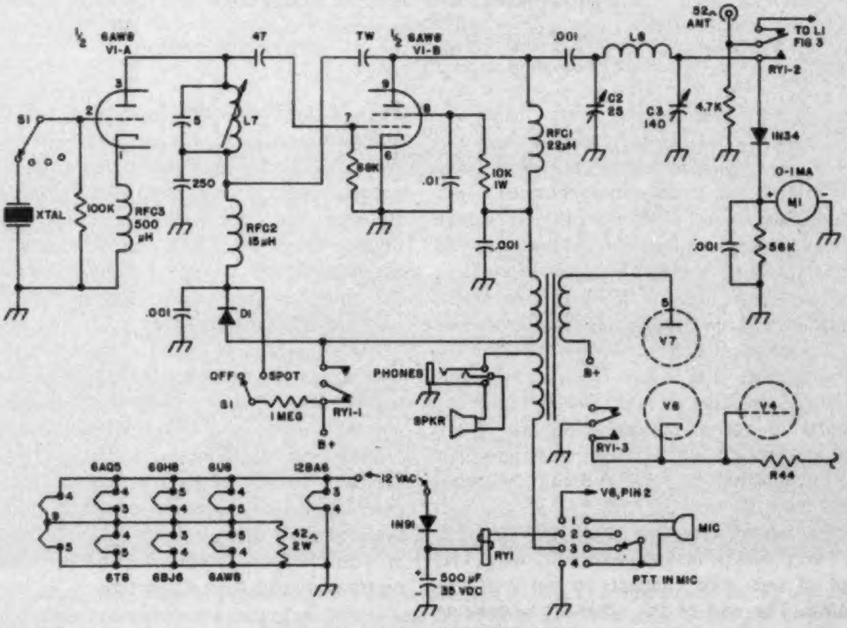

½ 6AW8
V1-A
47
TW
½ 6AW8
V1-B
.001
L8
52Ω
ANT
TO L1
FIG 3
RY1-2
S1
XTAL
100K
RFC3
500
μH
5
L7
250
RFC2
15μH
.001
D1
68K
.01
10K
1W
.001
RFC1
22μH
C2
25
C3
140
4.7K
1N34
0-1MA
M1
.001
56K
V7
B+
OFF
SPOT
S1
1MEG
RY1-1
B+
PHONES
SPKR
V6
V4
RY1-3
R44
6AQ5
6GH8
6U8
12BA6
12 VAC
6T8
6BJ6
6AW8
42Ω
2W
1N91
RY1
500μF
35 VDC
V6, PIN 2
MIC
PTT IN MIC

Fig. 2. Transmitter, filament, control.

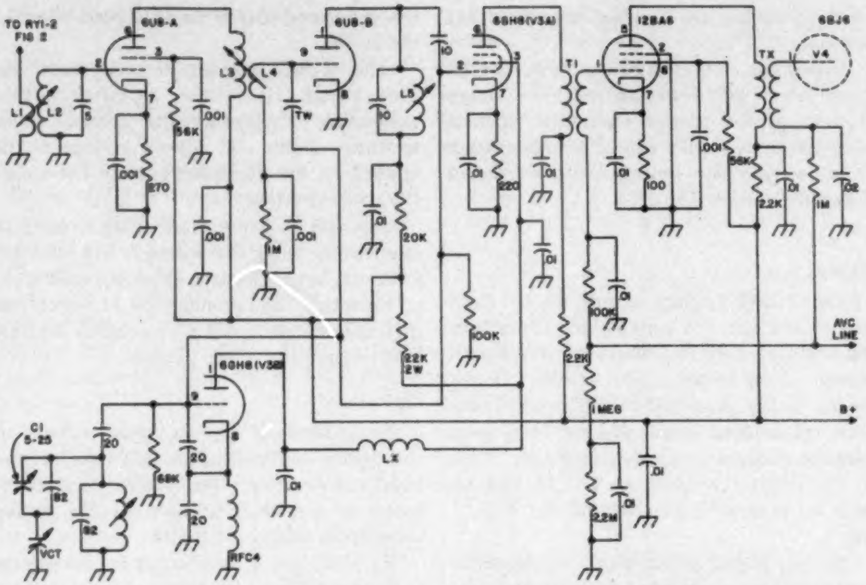


Fig. 3. Receiver. Resistors are in ohms, are ½W, except: K=1000, M=Megohm. Capacitors are in picofarads, decimal values are microfarads unless specified otherwise. Only parts not contained in the original unit are listed. L1 – 3 turns No. 22 insulated hook-up wire over the cold end of L2. L2 – 10 turns No. 32 enameled, close wound, ¼ in. slug tuned form Miller No. 4500. L3 – 12 turns No. 32 enameled, close wound, ¼ in. slug tuned form Miller No. 4500. L4 – 2 turns No. 22 insulated hook-up wire over cold end of L3. L5 – 18 turns No.26 enameled, close wound, ¼ in. slug tuned form (use original form). L6 – 7 turns No. 26 enamel, close wound, ¼ in. slug tuned form (use original form). T1, T2, TX – 1650 kHz i-f transformer, Miller No. 1732. VCT – original main tuning capacitor. C1 – 5 to 25 µµF NPO Ceramic trimmer capacitor. LX – Original receiver oscillator plate coil – left unchanged. TW – Twisted wire coupling capacitors.

The oscillator tuning range is set by adjusting C1 and L6. Increasing the value of C1 will increase the tuning range obtainable by "VCT" the main tuning control. Once the tuning range has been set the dial can be marked and calibrated. The old markings can be removed by using a fine grade sandpaper. The new markings, in 200 kHz increments, were added using Datak dry transfer decals.

The transmitter output is peaked by adjusting the slug in L7. The output circuit is a conventional Pi-tank and is tuned for maximum output indication on M1. If M1 needle pins a suitable dropping resistor can be inserted between M1 and the 56K resistor.

The neutralizing capacitor "TW" consists of two pieces of insulated hook-up wire. The end of one wire connects to pin 9 of the 6AW8. The end of the other wire connects to the junction of RFC2 and L7. The free ends of these two wires are twisted together enough to obtain stable amplifier operation. Any excess wire must be trimmed off after neutralization is completed. A final test for stability can be made by removing the crystal from the socket and running the amplifier 25 pF capacitor thru its range. If the amplifier goes into oscillation then it is not properly neutralized.

As a final touch, since the transceiver had seen rough CB handling, the front panel was repainted and lettered using Datak lettersets making control label changes as appropriate.

Although this conversion was made to a Comstat 19 the general principles can be used on other CB transceivers. With a minimum of cash outlay, depending on the size of your junk box, you can end up with a pretty good signal on six meters.

. . .W5QWY

Allen S. Joffe W3KBM
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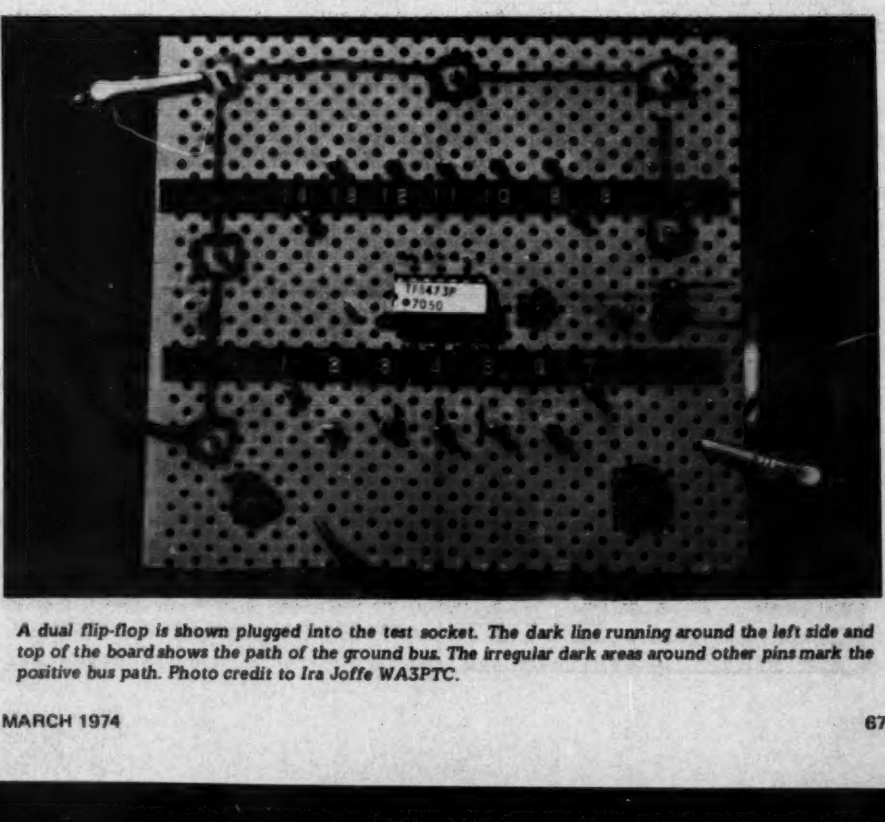
Dresher PA 19025

MACRO-IC-OLOGY

There comes a time in everyone's life when the feeling steals in that something is missing. After graduating from tubes to solid state, the something missing in my life turned out to be a test jig or fixture that DIP IC's could be plugged into for testing. Since half the fun of a test jig for microcircuits demands large size spread out for ease of use, I applied the science of *Macro IC ology* which is the art of making the small into the large.

The basic foundation is a 10.16 x 10.16 cm piece of .16 cm XXXP Bakelite punched with a .254 x .508 cm alternate grid. This is much cheaper than using the punched epoxy glass board whose chief virtue is its .254 x .254 cm hole pattern which is ideal for DIP purposes. Highly advanced amateur technology known as "making do" does call for possession of a small piece of this epoxy .254 x .254 cm board, which is used as a drilling template for the XXXP board. You simply align the two pieces of perforated board in the vicinity of where you wish to drill a standard DIP pattern. A little observation shows that the boards will line up with every other hole, piece to piece. You simply clamp the aligned boards in a vice and run a No. 60 drill through the "every other hole" that needs drilling in the XXXP board to establish your pattern. The two parallel rows of holes have a 1.02 cm separation between



A dual flip-flop is shown plugged into the test socket. The dark line running around the left side and top of the board shows the path of the ground bus. The irregular dark areas around other pins mark the positive bus path. Photo credit to Ira Joffe WA3PTC.

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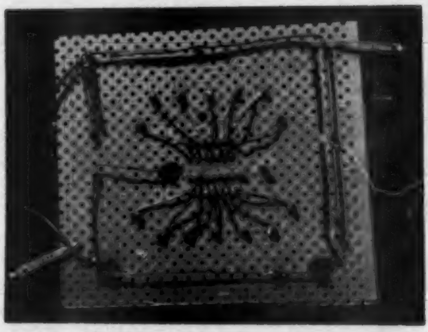

Arching of leads to IC shown to indicate facility for tack soldering to them. The leads leaving the right hand side of the board are for bringing an external power supply to the unit. The negative bus is traced out by the dark line adjacent to the wire. The positive bus is marked by the roughly circular areas around some of the terminals. Photo credit to Ira Joffe WA3PTC.

them, which quite naturally is the spacing of four holes in the template .254 x .254 cm epoxy board.

A 14 pin circuit stik DIP element was used to mount a matching IC socket in the center of the board. Push-in terminals were inserted into the 0.062 holes first to establish a wide open terminal arrangement for the socket pins which also allowed for clear numbering of the pins with a dymo label strip. Next, a row of terminals was marched around the board for a ground bus and a matching row for a positive bus. A long lead was attached to each bus to bring power to the board. A short red wire terminating in an alligator clip was tied into the plus bus and a similar black lead was wired to the ground bus. Since various IC's demand power to different pins this made it easy to supply such differing connections easily.

The connections from the IC pads to the push-in terminals was made with the heaviest solid wire that would go through the pad holes. These wires were deliberately arched above the board to facilitate their use for tack soldered cross connections as various test setups might call for. Naturally the push-in terminals also afford such tack solder locations. Try one of these and you too can strike a blow for *Macro IC ology*, while adding a very useful test fixture to your armament.

. . .W3KBM

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HOW THE COMMUNICATIONS RECEIVER BEGAN

The communications receiver appeared almost overnight it seemed, in late 1934. One month it didn't exist – and the next, there they were – the National HRO, Hallicrafters Super Skyrider, RME 9-D, RCA ACR-136 and the Patterson PR-12. Of course there were receivers for communications before this, but they were either the monstrous instruments of communications companies which occupied several relay racks or the inefficient regenerative receivers and superhets of amateurs. The small, self-contained, high-performance and versatile package we think of as a communications receiver simply did not exist.

Their sudden emergence in 1934 was only a surface appearance. It really began back in 1932. In June of that year, James Lamb, technical editor of *QST*, wrote an article entitled, "What's Wrong With Our CW Receivers?", in which he argued that the broad tuning and unstable receivers used by amateurs were not technically abreast of the contemporary crystal-controlled and well-filtered transmitters.

A second article (in the August *QST*), "Short-Wave Receiver Selectivity To Match Present Conditions" was subtitled, "Constructional and Operating Features of the Single-Signal Superhet." It described the use of the crystal filter for single-signal CW reception and, because increased selectivity demanded better frequency stability, showed how to stabilize the high frequency oscillator. In order to overcome the common objection that superhets were insensitive and noisy, he also discussed the principles of quiet and electrically stable rf amplifiers.

Here was a receiver with the high performance of a communications receiver, and versions of it were built by many advanced amateurs. By 1933 the crystal filter was offered as an option by several companies. Before the manufacturers could produce a true communications receiver on the production lines however, many practical problems had to be overcome. They had to gang and track three or four tuned circuits for single control tuning. An order of frequency stability never before achieved on a production line basis was forced by the adoption of the crystal filter. Better tuning mechanisms were required. Plugging in three or four separate coils would be anachronistic with such advanced receivers, so efficient methods of band changing were developed. Direct calibration required more uniform tuning capacitors in order to use mass-produced dials.

At the same time the public's interest in shortwave broadcast reception was ap-

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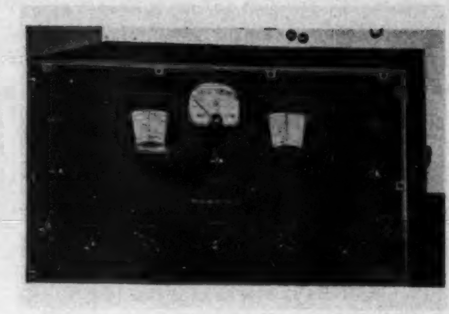
proaching the proportions of a craze. Almost all broadcast receivers covered a portion of the shortwave bands. Indeed, the all wave broadcast receivers were ahead of communications receivers in many areas. Bandswitching, direct calibration, avc and rf amplification were all in common use before their adoption by communications receivers. Several broadcast receivers used double conversion in the early 1930's, fifteen years before it was first used in communications receivers.

The receivers of the point-to-point communications companies in early 1934 were advanced in performance and often custom built, with special components. The big labs like RCA and Bell produced these, and they could afford to use components and techniques too expensive for amateur and broadcast receivers. These receivers often used diversity receiving techniques, and they would soon install single sideband systems for their trans-oceanic routes.

As 1934 opened the average amateur still used the regenerative receiver with one or two stages of audio and perhaps a stage of tuned rf amplification. This was the same basic receiver he had been using for fifteen years. Some phone operators used the superhet, but it was generally conceded to be less sensitive than the regenerative set. Being quite simple, the regenerative receiver was often home-built, but several commercial models such as the National SW-3 and SW-5 and the Pilot Super Wasp were popular.

An occasional commercial superhet was found in the shacks of hams. Perhaps the most advanced of these receivers was the National AGC which included an rf amplifier among its nine tubes. It had single control tuning, avc and offered an optional crystal filter. The AGC was a well-built and engineered instrument for "... the fortunate amateur who can select his station equipment without regard to cost, as well as the commercial operator to whom nothing less than the best is adequate ..." Three separate coils had to be plugged into the front panel to change bands. Frequency was determined by charts on the front panel and there was a separate power supply.

The Hammarlund Comet Pro was another superhet used by some of the more affluent



The Hammarlund HQ-120, original receiver in the famous HQ- series which was manufactured for over thirty years.

hams. This eight tube set had no rf amplifier and required plugging in two coils in shield cans on the chassis in order to change bands; avc and a crystal filter were optional extras.

Thus there were three classes of high frequency receivers in early 1934. The all-wave broadcast sets had most of the conveniences of modern communications receivers – self-contained, small, bandswitching, avc, calibrated tuning dial – but they were deficient in performance. The communication company receivers utilized modern techniques such as diversity reception, single sideband, stabilized oscillators and crystal lattice filters but were very bulky and prohibitively expensive. The amateur receiver was still in the dark ages of receiver development, having neither the convenience of the all wave broadcast set nor the performance of the commercial receivers.

Then in October, 1934, Hallicrafters announced the first of a long line of Super Skyrider receivers, a completely self-contained seven tube superhet. National announced their HRO for October delivery, and it was finally ready in December. By the end of the year the RCA ACR-136, RME 9-D, Patterson PR-12 and several others were on the market.

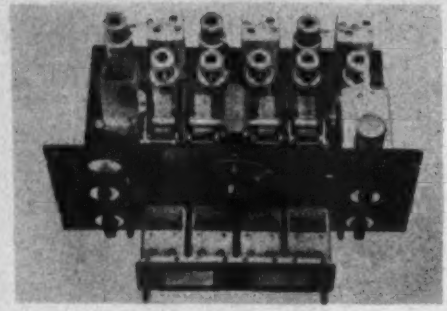
New developments came rapidly in 1935. Spurred on by the growing high frequency receiver market the components manufacturers developed improved insulation for bandswitches and coils, new metal tubes (6K7), acorn tubes to reduce input loadig and make amplification possible at higher frequencies, and iron core i-f transformers. The communications receiver manufacturers immediately introduced new sets incorporating improved techniques and components.

Hallicrafters, Silver (5-C), RCA (AR-60), Patterson (PR-16), Breting (12) and Sargent (20) all came out with new receivers during 1935. Tobe-Deutschman marketed both a general coverage and an amateur-bands-only receiver kit designed around the "Tobe Tuner," a pre-wired front-end.

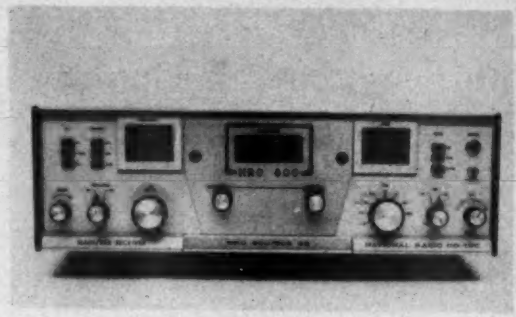
During 1935 Hallicrafters twice revamped their line, so fast were developments made. In January they announced three new models of the Super Skyrider, the S4, S5 and S6, differing in the frequency ranges covered. There was an optional crystal filter which added an "X" to the model designation, i.e., SX-4. In September they again revised the Super Skyrider. The new SX-9 had nine tubes and was the first communications receiver to use metal tubes and iron core i-f transformers. This was the last of the Super Skyriders with a built-in speaker. From 1936 Hallicrafters offered a complete line of receivers starting with the $29.50 Sky Buddy. By the end of the decade the model numbers had reached the SX-24. Other models which carried the Super Skyrider name were the SX-11, SX-16, SX-17 and SX-28.

Hallicrafters specialized in giving the most possible features for the dollar and in bringing new developments to the market in the fastest possible time. They did this by using almost all purchased components, capitalizing wherever possible on the low-priced, high-volume parts developed for all wave broadcast receivers.

National approached the manufacture of communications receivers differently. They designed and manufactured most of their own components including tuning capacitors, i-f transformers, coils and tuning mechanisms. When, in 1937, they brought out the medium-priced NC-80 series they were quite apologetic in their advertising. The accepted approach is to say that through superior engineering and a reckless disregard for profits a superior receiver is offered at a low price. National said, "Most amateurs do not need to be told that when a



Early photograph of a rack mounted version of the classic National HRO.



National HRO-600, a modern professional class receiver. A receiver with remotely similar performance would have occupied two six-foot relay racks in the 1930's.

communication receiver is to be sold for as low a price as the NC-80X it is necessary to make compromises."

It is also interesting that National did not employ the conventional coil switching method of band changing in any but their cheapest receivers until 1947. The HRO used plug-in coils until 1959. Other receivers in their line from 1937 used the movable coil system. Up to 24 coils were mounted in individual compartments in a die-cast aluminum pan installed on the bottom of the receiver. Sets of coils were moved into position and plugged in by moving the entire pan on rails through a geared arrangement from the band-change knob on the front panel.

The National HRO, the most famous and long-lived of the receivers which were introduced in late 1934, seemed doomed as an anachronism before it ever appeared. Yet it remained in production, basically unchanged, until 1949. It underwent modifications through the late 1950's, retaining to the last the famous PW dial and the plug-in coils. The receiver did not have direct calibration and had a separate power supply. It was a triumph for uncompromising design, disregarding as it did fashion, fad and expediency. A comparison of the performance of the original HRO with more modern receivers is given in the Table.

In 1933 Hammarlund started design of the ultimate receiver, the Super Pro, which was scheduled for release in early 1935. Their approach, like National's, was uncompromising. They designed a unique bandswitching mechanism, i-f transformers with variable coupling and a special twelve gang

Performance of the original HRO compared with some modern receivers.

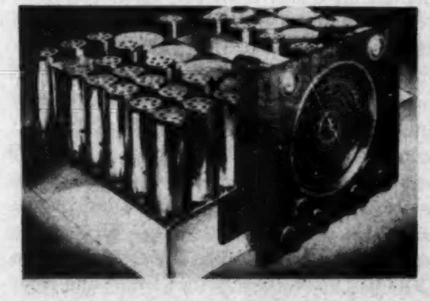
	National HRO (1935)	Hammarlund SP600 (1950)	National HRO-600 (1971)	Drake SPR-4 (1971)
Frequency Stability @ 14 MHz (max. drift)	28 kHz	1.4 kHz	30 Hz	100 Hz
Noise Figure	15 dB	10 dB	12 dB	11 dB
Frequency Readout Accuracy @ 14 MHz (max. error)	42 kHz	28 kHz	0.1 kHz	1.0 kHz
CW Selectivity Bandwidth and Shape Factor	200 Hz @ –6 dB 6–60 dB SF 30:1	200 Hz @ –6 dB 6–60 dB SF 30:1	400 Hz @ –6 dB 6–60 dB SF 6:1	400 Hz @ –6 dB 6–60 dB SF 7:1
Phone Selectivity Bandwidth and Shape Factor	3 kHz @ –6 dB 6–60 dB SF 8.5:1	3 kHz @ –6 dB 6–60 dB SF 6:1	2.4 kHz @ –6 dB 6–60 dB SF 2:1	2.4 kHz @ –6 dB 6–60 dB SF 3:1
Input Impedance	500Ω	100Ω	50Ω	50Ω
Image Ratio @ 30 MHz (min.)	25 dB	80 dB	90 dB	50 dB

tuning capacitor for the receiver. The project was so ambitious, however, that it was mid-1936 before the bugs had been eliminated and receivers were ready for delivery. But it was worth the effort, because the Super Pro turned out to be the most long-lived of all receiver designs. Minor revisions were made in the design in 1939 (SP-200) and in 1945 (SP-400) and in 1949 the SP-600 with double conversion and turret type coil changing was introduced. The SP-600 was sold as late as 1970.

Hammarlund brought out the HQ-120, a medium priced complement to the Super Pro, in 1939. This receiver was aimed at the amateur market to compete with receivers in the Super Skyrider price class. It became extremely popular and after the war evolved into the HQ-129, HQ-140, HQ-150 and finally the HQ-180 which was produced until 1970.

Meanwhile, the all wave broadcast receiver was reaching the height of its development in the creations of E.H. Scott and McCurdo Silver. Both companies specialized in custom receivers sold by mail and promoted through advertisements in magazines like *Radio News*. The sets were versatile in order to appeal to both the high fidelity music lover and the DX fan. They reached a peak in performance and ostentation with the new models late in 1937.

"The Amazing New Scott Philharmonic, World's Most Powerful Radio," headlined a full page ad in the September, 1937, *Radio*



Scott Philharmonic XXX, circa 1937. The receiver had a total of 30 tubes including four 6L6 audio output tubes on a separate chassis. It tuned 150 kHz to 80 MHz in six bands and its bandwidth was continuously variable from 2 to 16 kHz.

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News. The receiver contained thirty tubes on two chassis, had a 40 watt Class A audio amplifier, covered .15 to 80 MHz in six bands, had two separate amplified agc systems, one controlling the two rf amplifiers and the other the four i-f stages, and it had continuously variable selectivity from 2 to 16 kHz. This was perhaps the finest all wave broadcast receiver ever manufactured.

Silver's claims were no more modest and his receiver no less gaudy. "New McCurdo Silver Masterpiece VI, the Finest Receiver Ever Built," asserted his full page ad in the same issue of *Radio News*. While Silver's tube count was only 21, it generally matched the Scott feature for feature. It tuned .14 to 70 MHz in five ranges. It had two rf and three i-f amplifiers and dual amplified agc. There were four i-f bandwidths of 4, 8, 12 and 32 kHz and the 4 kHz bandwidth had a 6–60 dB shape factor of 2.25:1 and a 6–80 dB shape factor of 3.75:1!

World War II ended an era in the development of the communications receiver. Over 130 different models had been marketed by twenty-odd manufacturers. Of these only Hallicrafters, Hammarlund, National and RME resumed receiver production after the war. Gone were Howard, Breting, Patterson, RCA, Sargent, Meissner and Guthman. Gone also was much of the glamor and excitement because you rarely heard anymore about the people and ideas behind a new model. Big business methods prevailed and the new receivers were the product of anonymous engineering teams in obscure laboratories.

Looking back on the pre-war days from a distance of 35 years, the receivers now seem unimaginative after the original 1934–35 models. Everyone made the same receiver dressed a little differently. The standard communications receiver had one or two rf amplifiers, a mixer, a high frequency oscillator, a crystal filter, two or three 455 kHz i-f amplifiers, a second detector, bfo, and a couple of stages of audio. The techniques for SBB, dual conversion, lattice filters and most of today's refinements were available, but it wasn't until Collins introduced the 75A in 1947 that any manufacturer departed from Lamb's basic 1932 receiver design.

. . .Moore

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Phoenix AZ 85022

THE TRULY GREAT HAM

Most women have husbands with spare-time hobbies. I have a ham who's a spare-time husband.

Not that I'm complaining. I realize that the wife of a great man in any field has to make allowances for his genius – and my husband, if not a "great" ham, is definitely on his way to becoming one.

What does it take to be a Truly Great Ham? Well, it involves more than the ability to operate and maintain radio equipment. What it really means is being able to build an entire life around ham radio. The Truly Great Ham doesn't recognize the importance of any activity unless it can be related to radio in some way. I'm not sure that my ham would even bother to eat or sleep if he didn't need to keep up his strength for his daily radio operations.

What every ham likes best, next to using his radio, is talking about it. Of course he uses every opportunity to bring up the subject. But what can he do if some unenlightened person starts up a conversation that includes no mention of radio? The Truly Great Ham surely can't be expected to waste that golden tongue of his on commonplace subjects like the cost of living, how his wife spent her day, what to do about the leaking washing machine, etc. No, ham energies are best spent on more significant topics. So one of the skills very important to the Truly Great Ham is switching the conversation around to ham radio.

Sometimes my ham cheats. He has been known to sneak into the radio room and turn up the volume just before company is due. Then when everyone is seated comfortably in the living room and making small talk, he jumps up and disappears into the back of the house where all that squawking is coming from, saying, "Whoops – forgot to turn off the ham gear." Well, this is an opening guaranteed to lead into an evening of radio talk, especially since most guests are polite enough (or naive enough) to give him a further opening like, "Oh, are you a ham?" or, worse yet, "Oh, how interesting. I've always wondered how that stuff works."

This approach is usually good only for the first time people visit our home. After a few evenings of "Whoops – forgot to turn off the ham gear," even the politest and most tolerant guests would begin to wonder if a certain ham should be running around loose.

Any ham can do well with an opening like, "Oh, are you a ham?" or, "What sort of equipment is that?" or even "Is that a CB set? My brother used to have one." But the Truly Great Ham can get into his favorite subject with very little help. He has a well-tuned ear – he can hear a radio-related word whispered at 500 feet. It doesn't even matter if the context is completely wrong. One little word or phrase is enough to start some radio talk not necessarily related at all to what the original speaker had in mind.

Key words like communication, cable, switch, frequency, ham (for dinner or referring to a bad actor), tower (Eiffel or otherwise) will perk up a ham's ears, set his brain in gear and his mouth in motion.

My ham can pick up on the most innocent-sounding words. Sometimes he has to reach a little, of course. Mention chili for dinner and he remembers the time good ol' Morton's wife gave him some of her favorite chili. Good ol' Morton, of course, is better known as W7WRD and they were doing some repair work on his ham station that day.

Some people not interested in ham radio (not *necessarily* sickies) try to avoid radio talk by sticking to "safe" subjects. Where the Truly Great Ham is concerned, however, there is no safe topic. Not even the weather – the all-time great of safe, dull subjects – is safe from a ham's conversation switching. Mention that there's a breeze and the ham will be running out the back door, yelling something about making sure the antennas are guyed down tight. Should anyone notice the slightest rumble of thunder in the distance (and comment on it), he'll dash into the radio shack – if he's not there already – explaining he has to disconnect the equipment so lightning won't strike and blow up everything. This is often followed by that old favorite (and oft-heard) account of Old Ham Buddy Ferd who blew in the whole side of his house back in '56 because he forgot to disconnect . . . or the one about Old Ham Buddy Fard who unplugged his antenna seconds before lightning struck his roof. The Truly Great Ham, of course, has a mountainous stock of Old Ham Buddy stories to fit any occasion.

It's almost impossible to talk to my ham while we're driving anywhere. There's such a wealth of material along the road that he doesn't bother to switch the conversation anymore, but resorts to plain old interruption so he can comment on everything before it disappears in the distance behind us. A typical conversation goes like this:

Me: Did you know that . . .

Ham: Look at that tower (or telephone pole or 80 foot gas station sign or fire lookout, etc.). Would I love to put that up in the back yard!!

Me: Guess what . . .

Ham: Hey, there's K7JRK's antenna. See it through the trees?

Me: I forgot to tell you about . . .

Ham: Wow! *There's* an antenna setup! What I couldn't do with that! Must have cost him a fortune.

Me: Today I . . .

Ham: There's where we have our Wednesday night meetings.

Me: I think we should . . .

Ham: See that pizza place? That's where we all meet after Tuesday night meetings.

Me: Do you think that . . .

Ham: That's where K7YUK found the hidden transmitter . . . That's where K7ONO lives . . . etc . . . etc . . . etc . . .

My ham (and any Truly Great Ham) thinks any activity must be considered incomplete without a radio nearby. This includes, sad to say, intermission at a drive-in movie. Yes, unfortunately, even romance takes a back seat to ham radio. I discovered that the night I pointed out a beautiful full moon and was rewarded with a lecture on the possibilities of bouncing radio signals off it.

Experienced as I am with ham conversational techniques, I can still be surprised by a particularly brilliant move. There have been times when I really believed (silly me!) that my ham was about to carry on a conversation unrelated to radios. The other day, for instance, we were driving around and spotted the most beautiful house on a wooded hill. It had everything – solitude, trees, three fireplaces, swimming pool – everything we'd want if we had unlimited funds to spend on our dream house. "Look at that," I said. "That's the greatest thing I've ever seen. Wouldn't you love to live there?" "Yes," he said. "It's beautiful. It's just the kind of place I'd like to have someday." We stared longingly together as he continued, "The top of that hill is the perfect spot for an antenna. I could hit anyplace in the state from there."

Laura Sargent

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St. Clairsville OH 43950

INITIAL GENERATOR

. . .for the ham who has everything

In looking for a unique gift for a friend of mine, I decided to design and build a Morse code device for him that would generate his initials. I ruled out the use of a small tape recorder and used monostable multivibrators (one-shots).

Figure 1 shows the block diagram of this device. The Morse code generator (MCG) feeds one of the two inputs of a logic AND gate. The other input to the AND gate is a 600 Hz square wave generator (astable MV). With the MCG at a logic "1" level (+V), the AND gate enables the 600 Hz signal to be fed to the audio amplifier. With the proper sequence of pulses of different duration generated from the MCG, the output of the audio amplifier will be a series of dots and dashes.

Figure 2 shows the logic block diagram of the MCG. The MCG is unique in that it uses one-shots constructed from RTL NOR gates used as inverters. NOR gate 1 starts the sequence. With the logic "0" (zero volts) at E_{in}, the output of NOR gate 1 is at the "1" level (+V), and C_2 charges to $V_{CC} - V_{BE}$. With a logic "1" (+3.6V) at E_{in}, C_2 (left plate) is placed at ground potential because the output of NOR gate 1 is at "0" level. This action causes C_2 to cut off NOR gate 2 for a period of time approximately equal to $.7R_2C_2$.

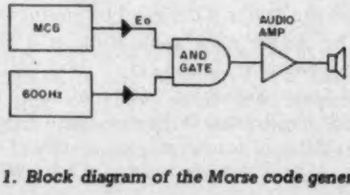


Fig. 1. Block diagram of the Morse code generator.

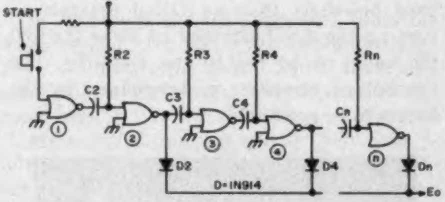


Fig. 2. Logic block diagram.

When NOR gate 2 is cut off ("1" level), a positive potential appears at the anode of diode D_2. This positive potential forward biases D_2 and represents a logic "1" at the input of the AND gate (Fig. 1). Thus a 600 Hz signal is fed to the audio amplifier for a period of time ($.7R_2C_2$).

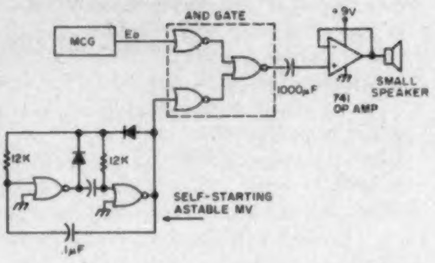
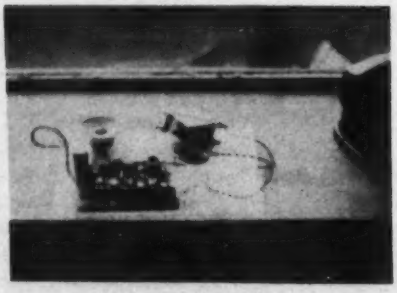


Fig. 3. The 600 Hz astable MV.

While NOR gate 2 is at the logic "1" level, C_3 is charging up to approximately $V_{CC} - V_{BE}$. When NOR gate 2 goes from the "1" level to the "0" level, C_3 causes NOR gate 3 to go from the "0" level to the "1" level. This process of generating pulses continues for each of the NOR gates connected as one-shots. Thus when NOR gate 2 produces a pulse of fixed duration, NOR gate 3 produces a pulse of fixed duration *after* NOR gate 2 produces its pulse. After NOR gate 3 produces a pulse of fixed duration, NOR gate 4 produces a pulse. This generation of pulses continues until all the one-shots generate a pulse.

These one-shots are connected to the AND gate through a diode OR gate. The timing of each one-shot is determined by R and C.

The individual one-shots are labeled dot, dash, letter space, and space between the dot and dash. The dot and dash one-shots are the only one-shots that are ORed together to turn on the AND gate and to allow the 600 Hz signal to be fed to the amplifier. The number of one-shots is determined by the letters to be generated.



Device built by W8JIX.

In the design, R is selected to ensure saturation of the NOR gates used as inverters. I used Motorola MC717P quad two-input NOR gates, although a HEP 573 could be used. C was selected to be 15 μF (measured to be 40–60 μF) at 6V dc. R was calculated to be

dot (•) R = 12K
dash (-) R = 27K
letter space R = 47K

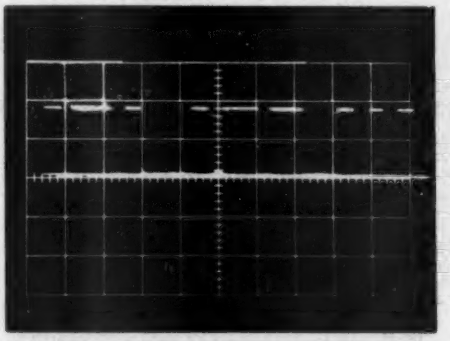


Fig. 4. Output of AND gate.

The 600 Hz astable MV is self-starting so that its output is present at all times. This astable is shown in Fig. 3. Figure 4 shows the output of the AND gate generating the letters "RWS." Any amplifier could be used to feed a loudspeaker. In the original Morse code device, I used a 741 operational amplifier feeding a speaker. This op amp does not produce a loud sound, but it is audible and suitable for the device (see Fig. 3).

I breadboarded the device using a vector board and two 1.5V batteries connected in series for the supply voltage. With the device idling, current drain is 50 mA. A NO push button switch is used to start the sequence of pulses (see Fig. 2). When power is initially applied, a series of pulses will be heard. Once these pulses are generated, momentarily pressing the start-button will generate the letters the device is designed to produce.

The device is an application of a Morse code generator found in a text entitled *Solid-State Switching: Discrete and Integrated*, by Robert D. Pascoe, John Wiley & Sons.

. . .W8JIX

Paul W. McCreery WA9IHV

REGULATED OSCILLATOR SCREEN FOR THE ART-13

As a group, amateurs that still operate ART-13's are not much different from anyone else. The one exception seems to be in their loyalty to the old "Airplane anchor."

Since I joined the ART-13 fraternity only two years ago, I am not as sensitive as some of the members of long standing. Nevertheless, I was incensed recently when I heard a well-known ART-13 XYL accused of frequency drift. When the same thing happened to me a few days later, I realized that something had to be done.

The Collins ART-13 oscillator, as many of you will already know, is built like a frequency standard. In fact my brother-in-law, who engineers for the Collins company intimates that their equipment doesn't drift. This piece doesn't, after a brief warm up, as long as the B+ voltage remains constant. In my case, a simple thing like turning on a 6KW clothes drier caused the oscillator to drift about 800 cycles.

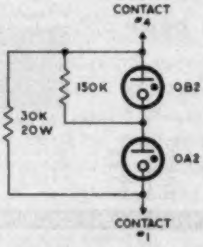
Determining the cause of the drift was easy but the solution was not obvious. Regulate the voltage of course – but how? The 837 oscillator tube has 450V on the plate. In addition to this, the circuit feeds several tubes making the current high. It would take a whole hatful of regulator tubes to regulate this mess.

Finally, I hit upon a plan. Since the ART-13 oscillator we are dealing with is electron coupled, the plate voltage has little effect on the plate current or frequency. Affirming this, I decided to regulate the screen voltage only. It is this voltage that controls the feedback, therefore if the plate voltage changes slightly the tube can't tell the difference.

The modification to regulated screen voltage is rather simple. First a small ell-shaped chassis is built to hold two regulator tubes and after it is wired as shown is attached to the perforated wall on the right side of the unused low frequency oscillator compartment. (If your ART-13 has a low frequency oscillator installed, you must remove it or hunt another spot.)

The connections are made to the contacts of P2601 which takes the place of the LFO unit. Be sure not to omit the 150K "firing resistor" because often the voltage is not high enough to start the OA2 if the OB2 should try to fire first.

With regulators mounted, the only task that remains is to remove the ground lead from R120. This is easier said than done because this resistor is located behind the autotune mechanism of control "D". However, with the autotune mechanism removed, the wires (there are actually two) can be removed from the top of the resistor and taped together.



In operation, the OA2 and OB2 tubes in series regulate the voltage to approximately 255V, while carrying about 20mA. These are good values for good stable operation in every way.

My modification was strictly "junk box," but some of you may have to spend $3.58 for the tubes and resistor. I was also lucky and have only $26 in my transmitter and homebrew power supply. Some of you may have spent a little more, but one thing is for sure: Making simple improvements, such as this one, to your ART-13 will give you pleasure and satisfaction that the "expensive rig hams" are sure to miss. It is this type of activity that keeps me a licensed amateur operating a homebrew receiver and an old "airplane anchor."

. . . WA9IHV

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ESTIMATING POWER TRANSFORMER RATINGS

Junk box transformers sometimes have a way of losing their identity with time. It isn't too difficult to determine the voltages of the various windings, but current ratings are another matter. I have found the best approach is to first get an idea of the overall power rating of the transformer. This is determined primarily by the amount of copper and iron in the transformer, so as an approximation the weight of the transformer will tell us roughly how many watts a transformer will handle.

With this idea in mind, several transformers of known ratings were weighed and their "watts per pound" determined by dividing the wattage rating by the weight. Here are some typical results:

Transformer Type	Watts	Wt/lb.	Watts/lb.
TV power	300	13.5	22.2
old radio power	132	7.5	17.6
battery charger	600	24.0	25.0
small radio power	40	4.25	9.4
instrument power	20	1.6	12.5

Generally speaking, the larger the transformer, the more watts per pound you get. This is to be expected since a larger transformer is more efficient than a smaller one. The table may be used as a rough guide in determining the wattage rating of your transformer. Weigh the transformer and multiply the weight by the estimated watts per pound for that weight. Next estimate the plate and heater current requirements for your application to see if the total number of watts is within the transformer ratings.

A word of caution when checking transformer windings on the ac line. *Always* use a test lamp in series with the winding until you are sure the winding connected to the ac line is indeed the primary. An unloaded transformer will show little or no primary current (lamp very dim) with the primary connected to the line.

. . .W6FPO

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THE QUIET MAKER

Low frequency audio filter for CW

Improving on a good idea from VU land: VU2NJ described recently (*QST*, February, 1972) some low-cost steps he took to improve the performance of his S4OA receiving setup. Most of the steps were quite conventional (adding voltage regulation, a converter, etc.) except perhaps for the means he used to improve the CW selectivity of the receiver. Apparently he didn't expect too many readers to immediately accept his approach to improved CW selectivity since floods of articles have appeared in magazines about audio filters for CW reception. Although his approach did not involve the usual audio peaking filter idea, it did involve shaping of only the audio passband in the receiver to improve CW reception. Basically, his idea was to copy CW at a very low pitch or beat frequency and then use an audio low pass filter to eliminate the higher frequencies and hence interference. The setting of the BFO in relation to the i-f passband would build one "wall" of what one can visualize as an overall filter and the other "wall" would be built by the low pass audio filter. Since only a low pass filter is involved there are none of the usual problems associated with a sharply peaked audio filter.

I was also dubious about the value of the idea but decided to give it a try, first in the form described by VU2JN which consisted mainly of just inserting a three section RC low pass filter between high impedance points in the audio amplifier stages in the S4OA. A similar audio filter was installed between the audio stages of a tube type transceiver. The results were really quite surprising. Copying CW signals at low beat notes of a few hundred Hz, one would notice a marked improvement in apparent signal selectivity and the higher pitched rasping frequencies were noticeably reduced so that the overall reception appeared quieter. The method hardly produced the selectivity results of a good i-f CW filter as VU2JN tended to claim but the method certainly had something to it and deserved further study.

The original RC low pass filter provided only a very gradual rolloff characterisitc or

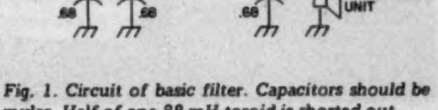

Fig. 1. Circuit of basic filter. Capacitors should be mylar. Half of one 88 mH toroid is shorted out.

attenuation of the frequencies higher than about 100 Hz. Also, although theoretically it shouldn't have been the case, the filter seemed to have too much insertion loss even at the very low frequencies requiring that the volume control on the transceiver be run wide open. The answer was to build a good low pass filter from LC elements. Building such a filter at the high impedance levels existing between tube stages would require very high values of inductance and hence expensive components. Also, since it doesn't make any difference where in the audio chain the filter is used and, to avoid any digging into the transceiver with which the filter was to be eventually used, it was decided to build an outboard filter. My rig has audio outputs available at both the 8 and 600Ω levels. The filter finally used was constructed for use in the 600Ω output since this was presently being used to drive a 'speaker." The "speaker" in use incidentally, was a receiver unit from a standard Western Electric telephone handset (Fair Radio Sales, Lima, Ohio, sells surplus telephone items.) The receiver unit is mounted in a small 7.62 x 10.16 cm bakelite enclosure with a few holes drilled in front to act as a grill and acts as an excellent SSB speaker because of its shaped communications type frequency response. The basic receiver unit will also act as an excellent dynamic microphone for SSB. But let's return to the filter description. A standard low pass filter was calculated for 600Ω and inserted in the speaker line. The final component values were then determined by experiment. The final circuit is shown in fig 1. The filter provides a sharp attenuation of frequencies above about 400 Hz.

Using the LC filter, the value of the low beat note type of CW reception could really be appreciated and it is really better than any type of peaked audio filter method of CW selectivity. There is absolutely no ringing to the circuit since a resonant filter is not involved. The reception is extremely quiet since all of the sharp high pitched notes which contribute to noisiness as well as fatigue in reception are eliminated. One can be receiving a signal with a 200 – 300 Hz pitch perfectly comfortably and then switch the filter out and hear other signals which

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would have made reception of the desired signal impossible without the filter. For the few dollars for parts, the filter is undoubtedly one of the best and easiest ways to improve the CW reception of a SSB transceiver. Better than a CW i-f filter? No. No audio filter will every replace a proper i-f filter but the filter described does come awful close.

A few additional notes about the filter are in order. The cutoff frequency of the filter shown in Fig. 1 is higher than VU2JN proposed but by trial and error I found it to be the best sounding arrangement. Others may wish to construct a filter with a still lower cutoff frequency perhaps going down to the 100 Hz VU2JN favored; I simply found the extremely low frequency beat note sounded too dull and lifeless to enjoy copying. If such a low cutoff frequency is used, however, it may be necessary to improve the basic low frequency gain of the audio section in a transceiver. This can be done usually by increasing by an order of 10 or more the value of the interstage coupling capacitors. There is no need to remove the filter when tuning across a CW band since one will not miss signals as is often the case when a sharply peaked single frequency CW filter is used. The filter does, of course, have to be removed for SSB reception although a modified version of the filter as described next does have value even for SSB reception. One may be inclined to construct the filter with multiple LC sections but my experience was that adding another pi section to the filter of Fig. 1 contributed only a barely noticeable improvement in performance. It appeared to be far more useful to experiment slightly with the capacitors in the pi

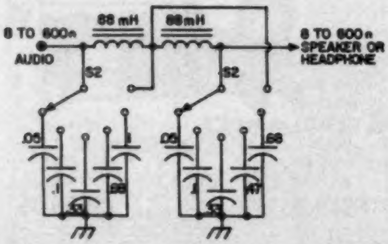

Fig. 2. Switchable filter allows wide selection of frequency roll-offs for CW or phone work.

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section to achieve the best attenuation of the higher frequencies. The capacitors used should be of the Mylar type, if possible.

The success of the simple filter prompted the author to also check if such a filter might have some value for phone reception. The filter of Fig. 1 has far too low a cutoff frequency to be usable on phone. I tried it on a phone signal and it almost completely destroyed the intelligibility of the signal. Low pass filters have often been used with cutoffs of 2500 to 3000 Hz to improve SSB reception and so it was decided to see if the filter characterisitcs could be modified by just changing the capacitor values to yield a higher cut-off frequency. By experimenting with different capacitor values, it was found that the cutoff frequency could be raised with a good degree of effectiveness to several thousand Hz although the filter no longer represented a proper textbook formula design. Exactly where one might desire to roll off the cutoff of the filter for phone reception becomes much more subjective than with CW reception. Therefore, if one were to build such a filter for both CW and phone use, it would be advisable to provide a range of frequency cutoff options. The circuit of Fig. 2 shows a filter with a wide range of switch selected capacitor values which in turn will provide suitable cutoff frequencies for the filter for either phone or CW reception. If the filter is built for use with a different impedance system, some simple experimentation with the capacitor values and number of toroid inductors used will quickly provide the correct values. An important point to remember when experimenting with this type of filter is that the textbook values for the nominal impedances of the components involved often do not apply. The speaker or headphones in use may well have a nominal impedance of 8Ω, for instance, but at a particular frequency the actual impedance may vary several times from this value.

After having tried the filter idea just described, I feel much the same as VU2JN did. The whole idea appears too simple to be worth while or effective, or not to have been thought of before. But it does work and indeed works fine. Give it a try.

. . .W2EEY

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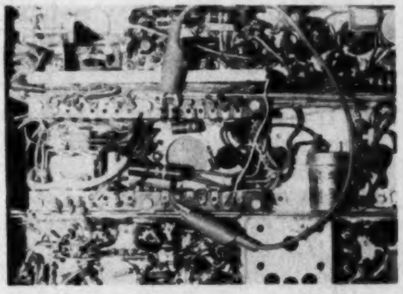
Use a 50 mA meter with the positive lead to ground and the negative lead to pin 4 on the receiver meter plug. The repeater can be used as a frequency standard.

While listening to a conversation on the repeater, check the meter reading. It should read zero. If it does not, adjust the receiver crystal oscillator for a zero reading (the small can right next to the crystal). You may have to consult a schematic if you are not sure which can is the crystal trimmer. An insulated tool is needed for this, a plastic screwdriver. Metal will detune the circuit. If the meter reading is below zero, reversing the meter pin will provide an up scale reading.



Motorola 41-V. Pin 10 (l), pins 6 & 7 (r).

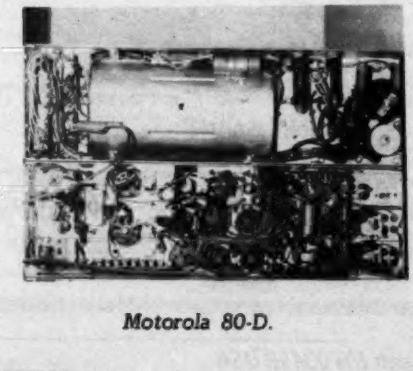
To net the transmitter to the receiver, jumper the receiver B+ voltage to the transmitter low B+ or multiplier circuit. This will provide a signal from the transmitter and if it does not read zero on the meter, adjust the transmitter oscillator capacitor for a zero reading on the meter. Transmitter adjustment is usually a slotted shaft on top of the chassis near the crystal (ordinary screwdriver may be used).

On the Motorola 80-D and 140-D, jumper from power supply terminal strip pin 9 to oscillator deck pin 2 on any of the three decks.

On the Motorola 41-V, jumper between receiver terminal strips pin 10 and transmitter terminal strip pins 6 and 7.

Jumper for a short period of time only.

. . . WA0GUD



Motorola 80-D.

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73

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Cassette Code Courses

With these Code Courses from 73, the average person can learn the International Morse Code fast enough to pass FCC code exams from Novice thru Extra Class in a few painless hours! One of the beauties of cassette tapes is that you can take them with you anywhere – at work for lunch break (code on rye is great) – even in the car while you are driving (or what's more likely, moldering away in line at a service station *trying* to get gas). With the help of these tapes passing the code portion of the various exams is a gas . . . *er* . . . snap!

My class was so enthused over your code cassette tapes that after hearing the 13 word per minute cassette every student in the class decided to get one for home practice. Enclosed is an order for 23 of the 13 word per minute tapes.

K6MLC

After about a week of playing your 13 word per minute cassette (which I timed out at 14 words per minute, incidentally!), I went down and passed the General exam with no strain. The plain language of the FCC exam seemed so slow that I lost all fear after the first few letters and made perfect copy from then on. It's fear that gets you, and your tape gave me confidence. Thanks!

WN9JGQ

I've been teaching code for over twenty years now and I've tried every record and tape and other gadget that has come out. Let me say that the 73 MAGAZINE code course is by far the finest that I have ever heard. I never thought I would learn new tricks, but you've taught me a lot about teaching code. Suffice it to say, I am recommending that every student of mine get your tapes.

K1IF

My wife, who has been almost totally resistant to the code, breezed through your 5 word per minute beginners cassette and was ready for the Novice exam in one day.

WB5JON

---

1 **Basic 5 WPM Code** – this cassette code course will teach the IMC at five words per minute, all letters, numbers and punctuation. The tape not only gives all these characters, but gives them in a very simple order so you can start copying code within one minute of hearing it. This has got to be the easiest way to learn code ever invented. The cassette actually has the code being sent at 6 WPM, allowing a margin for operator panic when the chips are down and the real exam is at hand.

Basic Code 5 WPM – 90 min. **$3.95**

2 **6 WPM Practice Tape** – (also known as The Back Breaker) this is a toughie – five character code groups sent in no particular order, so there is no way to memorize the tape. It is sent at six words per minute to give you that margin for error you'll need when faced with a stern examiner at THE EXAM. Practice in your head or on paper wherever you are, whenever you have a minute or two.

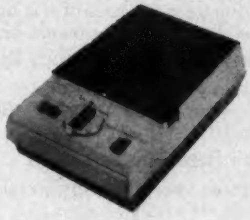
BB-6 WPM – 60 min. **$3.95**

3 **13 WPM Practice Tape** – This tape will take anyone over the hump which exists when you have to stop translating the dits and dahs, and go to an automatic recognition system where you "know" what the character is without thinking, thus enabling you to pass the general or advanced code test. This very nasty tape is really at 14 wpm, to give you that added edge when taking the exam.

BB-13 WPM – 60 min. **$3.95**

4 **20 WPM Practice Tape** – This cassette has been fiendishly designed to get you through the FCC Extra Class code test with flying colours. The code on this actually runs about 21 words per minute, though it starts out at a lazy 18 per for the first few minutes. The intermix of letters, numbers and punctuation instead of plain language will give you such an edge when you sit down to take the exam that you should be able to breeze through. Though much of your practice with this cassette can be just copying in your head – after all, the important object of practice is to train your brain to convert code into letters – be sure that you exercise your pencil too. The cassette will make your code practice portable, available to you whenever you have a few minutes to spare – even while driving.

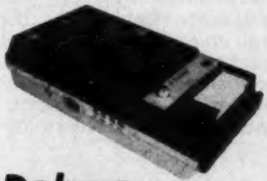
BB-20 WPM – 60 min. **$3.95**



Cassette Recorder

Here is a cassette recorder that is ideal for use with the code courses since it can be operated anywhere.

Comes complete with four "D" batteries, AC power cord, earphone and mike and is useful for dozens of ham applications. Cassette tape recorder is available for only **$23.95** (plus $1.00 for shipping and handling).



Deluxe Recorder

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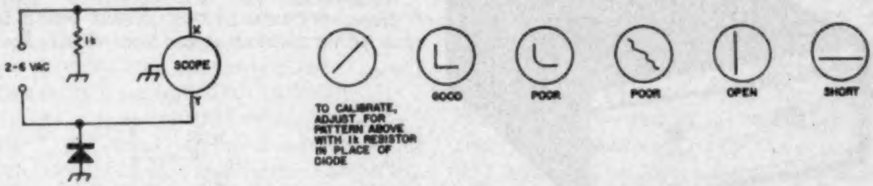
CIRCUITS, CIRCUITS, CIRCUITS...

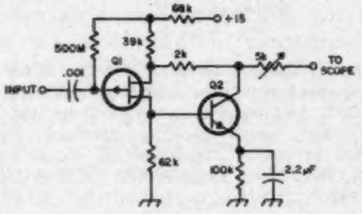
The following circuits have appeared in the referenced books, magazines, application notes, etc. While we try to reproduce all of the information that should be needed by an experienced constructor, readers may want to avail themselves of the original sources for peace of mind.

Readers are requested to pass along any interesting circuits that they discover in sources other than U.S. ham magazines. Circuits should be oriented toward amateur radio and experimentation rather than industrial or computer technology. Submit circuit with all parts values on it, a very brief explanation of the circuit and any additional parts information required, give the source and a note of permission to reprint from the copyright holder, if any, and the reward for a published circuit will be a choice of a 73 book. Send your circuits to 73 Circuits Page, 73 Magazine, Peterborough NH 03458.

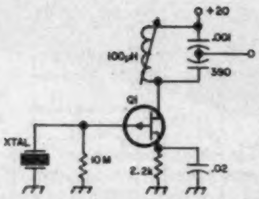


TO CALIBRATE, ADJUST FOR PATTERN ABOVE WITH 1k RESISTOR IN PLACE OF DIODE

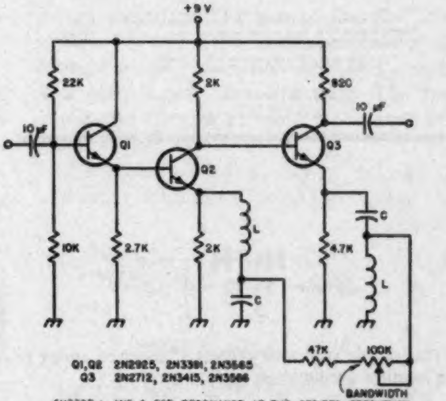
One of the easiest types of diode checks for a person with a scope is this, but it tells nothing about a diode's high voltage performance.



This high impedance probe provides about 1200 megohms input impedance with unity gain. Upper frequency equalization is provided by the 5K pot. Q1 is a U112, 2N2607, 2N4360 or T1M12; Q2 is a 2N706, 2N708, 2N2926, 2N3394, or HEP-50.



This is the old familiar vacuum tube Pierce oscillator circuit with a field effect transistor in place of the thermionic triode. Circuit constants shown here are for the 1 MHz region, but the tuned circuit may be adjusted to any frequency desired. Q1 is a 2N4360 or T1M12.



Q1,Q2 2N2925, 2N3391, 2N3565
Q3 2N2712, 2N3415, 2N3566

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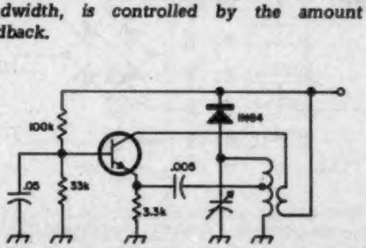

This circuit uses a diode to limit the output of an oscillator.

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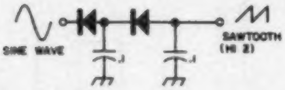
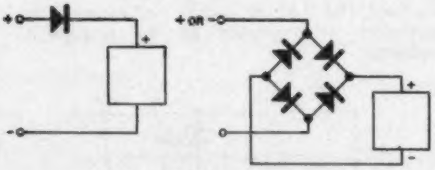
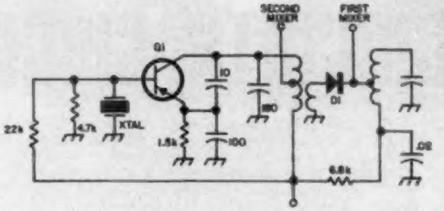

SINE WAVE
.1
.1
SAWTOOTH
(HI Z)

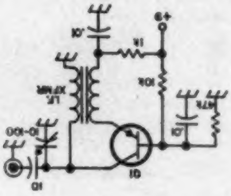
This simple sawtooth generator could be added to a monitor oscilloscope.



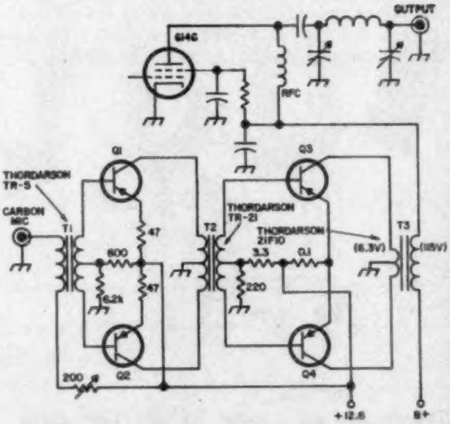
These two circuits protect equipment from incorrectly polarized voltage. The single diode keeps the equipment from working when the polarity is wrong, while the bridge automatically selects the proper polarity.


SECOND MIXER
FIRST MIXER
Q1
10
180
D1
22k
4.7k
XTAL
1.5k
100
.02
6.8k

Single oscillator and diode provide two injection frequencies for dual conversion receivers. Transistor Q1 is a 2N1745, 2N2188, TIM10, GE-9 or HEP-2; the diode should be a 1N82A or similar.



This beat frequency oscillator may be added to existing receivers with a minimum of difficulty. The BFO frequency is determined by the i-f transformer which provides feedback from collector to emitter. Transistor Q1 should be a 2N384, 2N1749, 2N2362, T1M10, SK3008, GE-9 or HEP-2.


6146
OUTPUT
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Q3
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CARBON MIC
T1
THORDARSON TR-21
T2
THORDARSON 21F10
(6.3V)
(115V)
T3
47
600
47
6.2k
3.3
0.1
220
Q2
Q4
200
+12.6
B+

25 watt modulator uses readily available commercial transformers. Transistors Q1 and Q2 are 2N1172, 2N301, 2N1560, SK3009, GE-9 or HEP-232; Q3 and Q4 are 2N174, 2N278, SK3012, GE-4 or HEP-233.

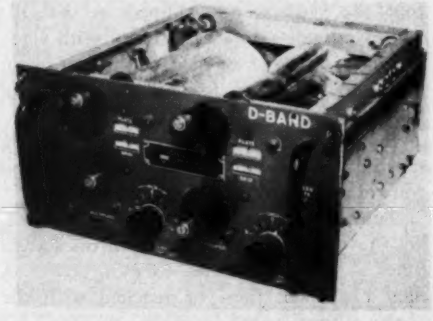
Ronald B. Cohen K3ZKO/AFA3ZKO
6629 N. 5th Street
Philadelphia PA 19126

THE AM 1187/TRC ON 450 MHz

This is not really a conversion article. There isn't any converting to be done to place this little gem into operation on any frequency from 400 MHz to 600 MHz.

The plug-in unit that we are discussing is the "D" band tuning head from the AN/TRC-24 radio transmitter T-302/TRC. This plug-in consists of two cavities. The first is a multiplier tripling up from two meters. Output in the 400 MHz to 600 MHz range from the multiplier is fed to the second cavity which is a straight-through power amplifier.

In the multiplier stage a 4X150A tube is used. The final amplifier uses a 4X150G tube. The 4X150G tube uses 2.5 volts at 6 amps on the filament. A much better tube to use in the final stage is a 4CX250K with a filament voltage of 6.3 volts at 2.5 amps.



The D-Band tuning bead can be operated as a 2m to ¾m tripler/amplifier without conversion, as the cavities can be tuned to range from the front panel. Using the final only with a 4CX250K tube we have obtained the following results:

PLATE VOLTAGE	*2000V dc*
PLATE CURRENT	*250 mA*
SCREEN VOLTS	*250V*
GRID RF DRIVE	*10W*

This resulted in 500W dc input and a measured output of 350W.

These "D" band heads can be used in many different arrangements. The first approach is not to modify anything but to apply the proper voltages to the ribbon connector on the rear of the unit and feed a two meter signal to the input. The output at 432 MHz will be approximately 150 watts depending on the voltages used and the amount of two meter drive that is used.

The second method is to use only the power amplifier. Disconnect the "N" connector P3 from the multiplier cavity and feed your low power FM, AM, SSB or ATV 432 MHz signal into this plug. The final could also be grid or plate modulated with external modulators.

The third and last way is to use the multiplier/amplifier for ATV. Using the

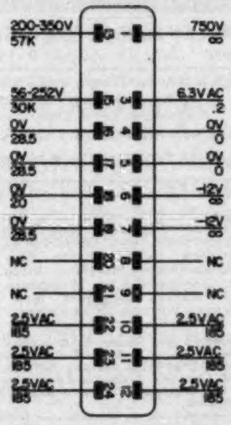


Fig. 1. Identification scheme for the ribbon connector on the rear of the unit. Upper values are operating voltages and lower values indicate the proper resistance as measured through the terminals from ground.

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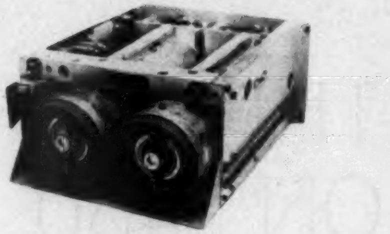

Rear view of the tuning unit showing the tubes mounted in the cavities. Note — never operate the cavities without proper air flow through them.

W6ORG video modulator[1] with an RCA CMU-15 Carfone transmitter strip, the output can be fed into the input of the amplifier through the N connector P3. You will be using the amplifier as a linear. The second method is to grid modulate using the W8VCO video modulator[2]. The main disadvantage of going this way is that the grid feedthrough capacitor C20 must be removed. If C20 is not removed the video bandwidth will be only about 500 kHz. There will still be a loss in bandwidth with C20 removed but the pictures will look good enough.

In tuning up with video a detected output to a scope is a must. The amplifier is tuned looking at the detected video making sure that the sync is not clipped or that the whites are going into saturation. With video transmission the best picture will not occur with the maximum forward power out of the amplifier.

Be sure to use an adjustable bias supply so you will have protection for the tube and control of operating point of the tube.

Tuning for CW conditions requires adjusting the plate, grid and load controls several times as you monitor the forward power. A final peak will then be reached with the power output.

Many of these AM-1187 heads are available through the MARS programs. We hope to see you soon on 439.250 MHz ATV with high power.

. . .K3ZKO/AFA3ZKO

---

1. ATV Video Modulator 73 June 1969 W6ORG Tom O'Hara.
2. Video Modulation 73 August 1963 W8VCO Robert Walker.

Jay Walton W5ACK
112 Island Drive
Richardson TX 75080

THE DRAKE R4B USED AS A 2m SIGNAL GENERATOR

Any owner of a Drake R4B can attest that it is one fabulous receiver. Not only is it great for its intended use, but there have appeared from time to time in the various journals methods by which the R4B could be tuned to "out-band" signals, such as WWV, with the crystals supplied for normal ham band use.

Related to this, but not exactly the same, I have found that the Drake crystal oscillator, PTO, and mixer can be used for a fairly accurate variable frequency signal generator and frequency meter for use on two meters, while at the same time maintaining the frequency resolution of the basic R4B PTO readout.

By using a crystal with a 0.0001% tolerance, frequency on two meters can be measured with approximately ±150 Hz ±PTO reading accuracy ±PTO linearity accuracy. That may seem like an awful lot of pluses and minuses, but it all adds up to about 300 Hz, or about 2 parts in 1 million. If we had that kind of accuracy on the low bands, it would come to about 6 Hz on the 3 MHz band. This is the poor man's way of measuring frequency on two meters with reasonable accuracy.

The uses for this capability are apparent. You can calibrate your discriminator for measuring the other fellow's deviation, or your own if you happen to have another receiver tuned to your transmitter output frequency. You can measure or confirm repeater frequencies. This method is by no means a commercial test set method; it is merely a ham's way of doing something within the realm of the average pocketbook.

Table I lists the crystal frequencies necessary for using the R4B dial conventionally to cover the entire two meter band. Of course, only those ranges of interest to you can be used.

These crystals should be specified for use in the Drake R4B and should have a 0.0001% tolerance. This will insure the 150 Hz deviation mentioned above. Crystals for use in other than the Drake units could result in deviations from nominal greater than the specified 0.0001%.

Table I

Tuning Range (MHz)	Crystal Frequency (MHz)
144.0–144.5	37.363750
144.5–145.0	37.488750
145.0–145.5	37.613750
145.5–146.0	37.738750
146.0–146.5	37.863750
146.5–147.0	37.988750
147.0–147.5	38.113750
147.5–148.0	38.238750

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The tuning range can be extended either side of the two meter band for special frequencies (MARS, commercial, etc.), by increasing or decreasing the crystal frequency by 125 kHz for each 500 kHz change in tuning range desired. For example, to tune from 148.0 to 148.5 MHz, the crystal required would be 38.238750 MHz plus 125 kHz, or 38.363750 MHz.

To use the crystal with the R4B, select the desired crystal with the XTALS switch to tune the desired range, place the R4B BAND switch in the 28.5 position, and tune the dial to the appropriate frequency of interest within the tuning range just as you would if you were using the receiver on the low frequencies. If the signal injection is not strong enough by pickup from your normal R4B operating configuration (two units I have can hear it fine), added signal can be obtained by taking the signal from the INJ jack on the back of the R4B. *Caution: If you are connected to a transceiver, do not transmit or it is goodbye R4B. Be careful and always on your toes.*

The setting of the PRESELECTOR is immaterial, although some peaking of the signal can be noted with the PRESELECTOR around the 15 to 10 meter positions, but this peaking is only in the order of 3 dB or so.

For those of you who might have the desire to know what frequency range you would tune using these special crystals in the "normal" manner, just subtract 11.1 MHz from the crystal frequency to determine the low end of the 500 kHz tuning range. For example, if you have the crystal which would permit tuning 146.0–146.5 MHz selected, and you use it in the normal manner, the low end of the PTO tuning will be at (37.863750 minus 11.1) MHz, or 26.763750 MHz.

. . .W5ACK

Editor's Note:

International Crystal's type CS-O5, ±.0025% crystals cost about five to ten dollars. Their oscillator unit OE-5 can be processed and adjusted to within .0001% for considerably more. The standard CS-O5 37 MHz crystal costs in the neighborhood of $7.50.

Walter W. Pinner WB4MYL
7304 Lorenzo Lane
Louisville KY 40228

FM CONVERSION OF G.E. LOW POWER INDUSTRIAL TRANSCEIVERS

Many of these units are showing up at hamfests in the $20 to $40 price range. They are available with either a dc vibrator or a 115 ac built-in power supply. A receiver sensitivity of .7 μV and a transmitter output of 3W is easily obtained with the following information.

Necessary Equipment

Grid dipmeter or indicating wavemeter, 50 μA to 100 μA meter (almost any vom will do if a separate meter is not available). A 50Ω dummy load (2 parallel 100Ω 2W resistors) or a No. 47 pilot lamp and the proper crystals. Crystals should be purchased from a reputable supplier. The cost will be about $12 per set and you should supply the following information when ordering.

Receiver model number (stamped on side of chassis); *desired receive frequency* (146.94 MHz); *oven or non-oven type* (these units usually are non-oven type); *transmitter model number* (stamped on side of chassis); and *transmit frequency* (146.94 MHz).

While you are waiting for the crystals to arrive you can perform the following modifications.

1. On the transmitter chassis, compress the coil at C119 tightly together (all the components referred to are plainly marked on the chassis top).
2. On the transmitter add one turn or re-wind with one additional turn, the two coils at C-124A and C-124B.
3. Jumper out the 2.7K 2W resistor connected to J114. This is under the chassis and near the 6AN5 output tube.

This completes the modifications. All that remains is realignment. When the crys-

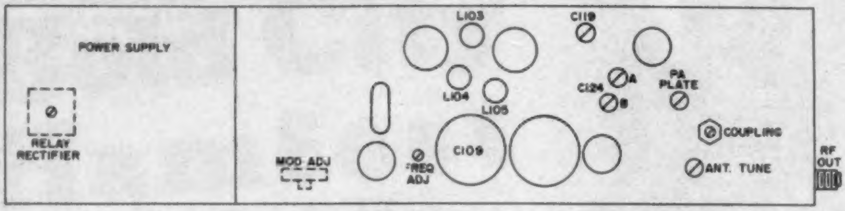

Fig. 1. Transmitter

tals arrive, install them in the proper sockets and you are ready to align the transmitter. Connect an swr bridge and dummy load to the antenna connector. You may also use a No. 47 lamp as an indicator/load. When properly tuned the No. 47 lamp will light to normal or better brightness. Remove the 6AN5 output tube from its socket. To key the transmitter for the following steps, depress the red test switch located on top of the chassis near the control head. Apply power to the unit and with the dipmeter or wavemeter set to about 12 MHz, couple to coil L-103 and adjust L-103 for maximum indication. In the same manner adjust L-104 for maximum indication at 12 MHz. Set the dipmeter for 36 MHz and couple to and adjust L-105 for maximum output. Set dipmeter to 73 MHz, couple to and adjust C-119 for maximum output from L-107. Set dipmeter to 146 MHz, couple to L-109 and adjust C-124A for maximum output. Reinstall the 6AN5 tube and using the swr bridge or No. 47 lamp as an indicator, key the transmitter and tune C-124B, C-128 (P.A. Plate), and C-129 (antenna tune) for maximum output. Double check the output at the 6AN5 tank coil for 146 MHz output with the dipmeter. This completes the transmitter tuneup.

Receiver Alignment

Couple the dipmeter or wavemeter to the bottom of Z-306 and adjust Z-305 and Z306 for best output at about 139 MHz. Only a slight adjustment inward will be necessary on these two coils. If you have ordered crystals for simplex (transmit and receive on the same frequency) you may use the transmitter as a signal source for the remainder of the alignment by connecting a jumper from any red B-plus transmitter lead to any red B-plus receiver lead. The dummy load should be moved from the antenna jack to the antenna relay below the chassis. Connect the load to the relay terminal that connects to C-125 the antenna tune capacitor. Connect the 50 μA meter betweeen the green limiter jack, near the volume control, and ground. With the B-plus to B-plus jumper in place, adjust the following in the order given: Z-304, Z-303, Z-302, Z-301, T-301 for maximum meter reading. Once this preliminary alignment has been accomplished, move the meter to the orange Disc. jack. Adjust L-307 for a "0" current reading. You should be able to vary the receive crystal frequency for an indication above and below 0. Having done this, you know *your* transmitter and receiver are on the same frequency. You may now make a final

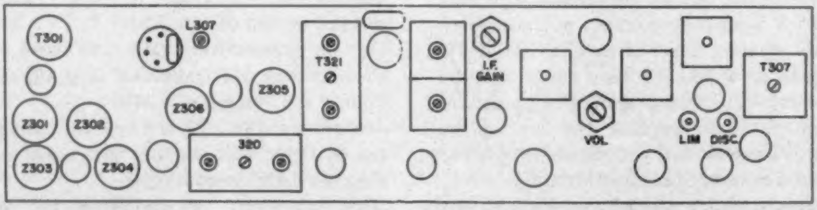

Fig. 2. Receiver

receiver tuneup. Remove the 6AN5 tube to reduce the signal and with the meter in the green Lim jack, as before adjust Z-304 through T-301 for maximum meter reading. You may wish to reduce the setting of the i-f gain control for this final adjustment. Remove the B-plus jumper, dummy load, and replace the 6AN5 tube.

Final Frequency Adjustment

While receiving an on-the-air signal such as the local repeater or other station as a standard, meter the discriminator current and adjust L-307 for 0 current indication. Reinstall the B-plus jumper and adjust the transmitter crystal trimmer (freq, adj.) for 0 reading. Your receiver and transmitter are now on the reference station's frequency. The modulation or frequency deviation is adjustable up to 20 kHz. An on-the-air audio report is the simplest way to make this adjustment, if necessary.

Service Hints

Below is a list of common problems you may experience.

Relay chatter – replace the bridge rectifier on the bottom of the power supply chassis – a common failure. 100 piv 1A diodes are o.k.

No or weak receive– i-f transformers T320 or T321 will open where the coil leads attach to the terminal internally. This is easily repaired by removing the transformer. Disassemble and resolder the connection.

Poor audio – mike voltage is developed at the cathode of the 6AK6 transmitter tube. Check for proper transmitter alignment, good 6AK6 tube, and replace C109 the mike voltage filter.

Unable to align transmitter – several units converted had faulty trimmer caps. C-117, C-124 A&B, Antenna tune. Mechanically these caps would rotate, but they did not change electrically. This fault may be detected by a slight irregularity in the force needed to rotate them.

In conclusion, mobile units seem to be less expensive than units with ac supplies. Should you elect to build your own ac supply, you will need the following voltages: B-plus – 200V dc @ 145 mA, relay dc – 9V dc @ .5A, fil. ac – 6.3 @ 5.5A or 12.6 @ 3A.

. . .WB4MYL

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*They tried to prevent us from publishing a transcribed picture of the Swedish Nude, but we did it anyway!

FCC RULES AND REGULATIONS, PART 97 (VIII)

Continuing from December, the complete test of the FCC Rules and Regulations pertaining to the Amateur Radio Service.

Subpart F—Radio Amateur Civil Emergency Service (RACES)

TECHNICAL REQUIREMENTS

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97.195 Classification of emissions.
97.197 Transmitter power.
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OPERATING REQUIREMENTS

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USE OF STATIONS

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97.215 Limitations on use of stations.
97.217 Hours of operation.
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TECHNICAL REQUIREMENTS

§ 97.193 Frequencies available.

(a) Except as provided in paragraph (e) of this section, the following frequency and frequency bands and associated emissions are available on a nonexclusive basis to the individual class of stations or units of such stations in the Radio Amateur Civil Emergency Service.

(1) For use only by authorized stations or units of such stations which are operated under the direct supervision of duly designated and responsible officials of the civil defense organization:

Frequency band:	*Authorized emission*
1800–1825 kHz [1]	0.1A1, 1.1F1, 6A3
1975–2000 kHz [1]	0.1A1, 1.1F1, 6A3
3500–3510 kHz	0.1A1, 1.1F1
3990–4000 kHz	0.1A1, 1.1F1, 6A3, 6F3

[1] Use of frequencies in the band 1800–2000 kHz is subject to the priority of the Loran system of radionavigation in this band and to the geographical, frequency, emission, and power limitations contained in § 97.61 of the rules governing amateur radio stations and operators (Subparts A through E of this part). The use of these frequencies by stations authorized to be operated in the Radio Amateur Civil Emergency Service shall not be a bar to expansion of the radionavigation (Loran) service, and such use shall be considered temporary in the sense that it shall remain subject to cancellation or to revision, in whole or in part, without hearing, whenever the Commission shall deem such cancellation or revision to be necessary or desirable in the light of the priority within this band of the Loran system of radionavigation.

(2) For use by all authorized stations only in the continental United States, except that, the bands 7245–7255 and 14.220–14.230 kHz are also available in Alaska, Hawaii, Puerto Rico, and the Virgin Islands:

Frequency band:	*Authorized emission*
3510–3516 kHz	0.1A1, 1.1F1.
3516–3550 kHz [1]	0.1A1, 1.1F1.
3984–3990 kHz	0.1A1, 1.1F1, 6A3, 6F3.
7097–7103 kHz	0.1A1, 1.1F1.
7103–7125 kHz [1]	0.1A1, 1.1F1.
7245–7255 kHz [1]	0.1A1, 1.1F1, 6A3, 6F3.
14047–14053 kHz	0.1A1, 1.1F1.
14220–14230 kHz [1]	0.1A1, 1.1F1, 6A3, 6F3.
21047–21053 kHz	0.1A1, 1.1F1.

[1] The availability of the frequency bands 3516–3350 kHz, 7103–7123 kHz, 7245–7247 kHz, 7253–7255 kHz, 14220–14222 kHz and 14228–14230 kHz for use during periods of actual civil defense emergency is limited to the initial 30 days of such emergency, unless otherwise ordered by the Commission.

(3) For use by all authorized stations:

Frequency or frequency bands:	*Authorized emission*
3997 kHz [1]	0.1A1, 6A3.
28.55–28.75 MHz	0.1A1, 6A3, 6F3, 6A4.
29.45–29.65 MHz	0.1A1, 1.1F1, 6A3, 6A4, 40F3.
50.35–50.75 MHz	0.1A1, 6A2, 6F2, 6A3, 6F3, 6A4.
53.30 MHz [1]	40F3.
53.35–53.75 MHz	0.1A1, 1.1F1, 6A2, 6F2, 6A3, 6A4, 40F3.
145.17–145.71 MHz.	0.1A1, 1.1F1, 6A2, 6F2, 6A3, 6A4, 40F3.
146.79–147.33 MHz.	0.1A1, 1.1F1, 6A2, 6F2, 6A3, 6A4, 40F3.
220–225 MHz	0.1A1, 1.1F1, 6A2, 6F2, 6A3, 6A4, 40F3.

[1] For use in emergency areas when required to make initial contact with military units; also, for communication with military stations on matters requiring coordination.

(b) The selection and use of specific frequencies within the authorized frequency bands by stations in the Radio Amateur Civil Emergency Service shall be in accordance with a coordinated local area and adjacent area civil defense communications plan and applicable rules of this part.

(c) Except as provided in paragraph (d) of this section, at such time as any or all of these frequency bands are withdrawn from availability to stations operating in the Amateur Radio Service, such bands shall be jointly available to stations in the Radio Amateur Civil Emergency Service and to stations in the military services for training and tactical operations. At that time, in areas where interference might occur, local mutual arrangements shall be made regarding times of operation such as to preclude or satisfactorily alleviate interference. In time of actual civil defense emergency, stations in the Radio Amateur Civil Emergency Service shall have absolute priority.

(d) In the band 220 to 225 MHz, stations operating in the Radio Amateur Civil Emergency Service shall not at any time cause harmful interference to the government radiolocation service.

(e) A repeater station in the Radio Amateur Civil Emergency Service may operate on any frequency, and with any associated emission, above 50 MHz listed in paragraph (a) of this section, except for 220 MHz to 222 MHz.

[§ 97.193(a) *amended and* (c) *added eff. 10–17–72; VI(72)–1*]

§ 97.195 Classification of emissions.

(a) For the purposes of this subpart, the authorized emissions, as contained in the table of § 97.193, are defined as follows:

0.1A1—Continuous wave telegraphy.
1.1F1—Frequency shift telegraphy.
6A2—Telegraphy amplitude modulated at audio frequency.
6F2—Telegraphy frequency modulated at audio frequency.
6A3—Commercial quality amplitude modulated telephony.

6F3—Narrow band frequency or phase modulated telephony.
40F3—Wide band frequency or phase modulated telephony.
6A4—Amplitude modulated facsimile.

(b) On frequencies where wide band frequency or phase modulated telephony (40F3) is authorized, narrow band frequency or phase modulated telephony (6F3) may also be employed; similarly, where commercial quality amplitude modulated telephony (6A3) is authorized, single or double sideband amplitude modulated telephony, with or without carrier or with reduced carrier, may also be employed.

§ 97.197 Transmitter power.

The transmitting equipment of a radio station in this service shall be adjusted in such manner as to produce the minimum radiation necessary to carry out the communications desired. No station operating in this service shall use a direct current plate power input to the vacuum tube or tubes supplying energy to the antenna in excess of that permitted to be used by a licensed amateur radio station when operated on the same frequencies or in the same frequency bands in accordance with the provisions of the rules governing amateur radio stations and operators (Subparts A through E of this part).

§ 97.199 Equipment requirements.

(a) Except under the conditions specified in paragraph (b) of this section, all stations authorized to be operated in the Radio Amateur Civil Emergency Service shall be capable of receiving on the same frequencies or frequency bands utilized for transmission.

(b) When a station in this service is operated only on a single frequency or frequency band for cross-band operation in communication with a station or stations operating on another frequency or in another frequency band, or in other services, such station shall be capable of receiving the station with which it is communicating.

(c) The direct modulation of an oscillator with a frequency stability less than that obtainable with crystal control, or the radiation of a signal having simultaneous amplitude and frequency or phase modulation, is prohibited on frequencies below 220 MHz.

§ 97.201 Alleviation of harmful interference.

(a) When emissions of stations in the Radio Amateur Civil Emergency Service, other than those necessary to carry on the desired communications, cause harmful interference to stations in this or any other service, the Commission may, in its discretion, require appropriate technical changes in the equipment to alleviate the interference.

(b) When the emissions of stations in the Radio Amateur Civil Emergency Service that are necessary to carry on the desired communications cause harmful interference to stations in other radio services, appropriate action shall be taken to alleviate such interference including, if necessary, the suspension (except during times of an actual state of civil emergency) of such emissions as cause the interference.

OPERATING REQUIREMENTS

§ 97.203 Operator requirements.

(a) No person shall operate a station in the Radio Amateur Civil Emergency Service unless (1) that person holds a valid radio operator license of the proper grade, as described in this section, and (2) that person holds a valid written certification by the chief of the local, regional, or state Civil Defense organization of the area in which he serves that he has satisfied all federal, state, and local requirements for enrollment in the Civil Defense organization as a radio operator and is actually enrolled therein. Such certification shall clearly indicate that a determination has been made as to his loyalty to the United States and general reliability in accordance with the procedures described in the approved civil defense communications plan for the area concerned. (See §§ 97.163(l) and 97.169.)

(b) The person manipulating the key of a manually operated radiotelegraph transmitter of a station authorized to operate in this service shall hold either (1) any class of amateur operator license issued by the Commission, other than the Technician or Novice Class, or (2) any class of commercial radiotelegraph operator license issued by the Commission other than the Temporary Limited Radiotelegraph Second Class Operator License, together with the certification required in accordance with the provisions of paragraph (a) of this section.

(c) Except as specifically provided in paragraphs (a) and (b) of this section, any station in the Radio Amateur Civil Emergency Service may be operated by the holder of any class of amateur or commercial radio operator license issued by the Commission other than a Temporary Limited Radiotelegraph Second Class Operator License or an Aircraft Radiotelephone Operator Authorization: *Provided*, That, when such operation is performed by the holder of a Novice Class amateur operator license or by the holder of a commercial radiotelephone or radiotelegraph third class operator license or restricted operator permit; (1) such operator shall be prohibited from making any adjustments that may result in improper transmitter operation, (2) the equipment shall be so designed and installed that none of the operations necessary to be performed during the course of the normal rendition of the service of the station may cause off-frequency operation or result in any unauthorized radiation, and (3) any needed adjustments of the transmitter that may affect the proper operation of the station shall be regularly made by or under the immediate supervision and responsibility of the holder of either an amateur operator license other than the Novice Class or a commercial radiotelephone or radiotelegraph first or second class operator license.

(d) All adjustments or tests during or coincident with the installation, servicing or maintenance of the transmitting equipment of a station in this service shall be made only by or under the immediate supervision and responsibility of the holder of either (1) an amateur operator license other than the Novice Class or (2) a commercial radiotelephone or radiotelegraph first or second class operator license issued by the Commission, who in addition holds the certification required in accordance with the provisions of paragraph (a) of this section.

§ 97.205 Operation at other than licensed location.

A station in this service, or any unit thereof, may be operated at any location in accordance with the approved civil defense communications plan for the area concerned, in the discretion of and as directed by the Civil Defense Radio Officer, without notice to the Commission and without limitation as to the length of time within which such operation takes place: *Provided*, That nothing in this section shall be construed to waive the necessity for modification of the authorization of a station in this service when the address of the licensee or the basic location of the station is changed, or for any other reason where, because of a change of the communications plan or other reason, the information heretofore furnished the Commission with the original application may be materially altered or changed.

§ 97.207 Availability of station authorizations and operator licenses.

(a) The original station authorization permitting operation of the licensed amateur station in the Radio Amateur Civil Emergency Service, or a photocopy thereof, shall be permanently attached to each transmitter of such station, including each transmitter which is capable of being operated and intended to be operated independently at different locations, if the transmitter is readily accessible, or, if the control position is located at a place other than the transmitter location, it may be posted at the control position: *Provided*, That, whenever a photocopy of the station authorization is utilized in compliance with the requirement of this paragraph, the original station authorization shall be made available for inspection upon reasonable request from any authorized representative of the Federal Government.

(b) The original radio operator license, or a verification card (FCC Form 758–F) in the case of the holder of a commercial radio operator license of the diploma type, of the operator controlling the emissions of a station authorized to be operated in this service together with the certification required by § 97.203(a), shall be carried on his person or kept immediately available at the place where he is operating the station or any independent unit of a station: *Provided*, That, whenever a verification card (FCC Form 758-F) is utilized in compliance with the requirement of this paragraph, the original operator license shall be made available for inspection upon reasonable request from an authorized representative of the Federal Government.

(c) When a licensed amateur station, or an independent unit of such station, is operated at a location other than that shown in its license in compliance with the provisions of this subpart, the basic amateur station license required by Subparts A through E of this part need not be readily available at the station or unit location, but shall be made available for inspection upon reasonable request from any authorized representative of the Federal Government.

§ 97.209 Radio station log.

(a) Except as otherwise expressly provided in this subpart, there shall be maintained at each radio amateur civil emergency station, or unit of such station, an accurate log of all operations. The following information shall be recorded in such station log:

(1) The name and address of the station licensee, the regularly assigned call sign of the station and unit number if any, the name of the radio amateur civil emergency network or networks in which the station is normally operated, and the d.c. plate power input to the vacuum tube or tubes supplying energy to the transmitting antenna system. This information need be entered only once in the log unless there is a change in any of the items specified in this subparagraph, but the original entry and each change shall show the date on which the entry was made.

(2) The date and time of beginning and end of each period during which the station was operated, the purpose of such operation, and the frequencies or bands of frequencies on which the operation took place.

(3) The call signs or other identification of all stations or units of such stations with which communications are established or attempted during such period of operation.

(4) The signature of the licensed operator on duty and in charge of the operation of the station or unit of such station during each period of operation, and the signature of each licensed operator who manipulated the key of any manually operated radiotelegraph transmitter of such station or unit. The signature of the operator shall be entered with the date and time at the beginning and end of each period during which he performed the foregoing duties, and at least once on each page additional to the first page, covering the period for which he was the responsible operator. The signatures of any additional operators who operate the transmitters(s) during the regular watch of another operator and details to indicate the periods during which they operated the transmitter(s) shall be entered in the proper form.

(5) Upon completion of each period of operation for any purpose, there shall be entered in the log a summary of such operation describing the nature thereof and, if message traffic or other record communications were exchanged with other stations, an estimate of the amount of such traffic handled together with a report on any unusual delays which were experienced in the delivery of such messages.

(6) There shall be no erasure, obliteration, or destruction of any part of the log of any station or station unit. Corrections shall be made by striking out the erroneous portion and initialing and dating the corrections.

(b) Mobile radio amateur civil emergency stations or station units, and portable radio amateur civil emergency stations or station units, where not being operated at pre-determined fixed locations, shall be exempt from the requirements of maintaining a log to the extent that the entries required under the preceding paragraph of this section are substantially contained in the log of another station or stations operating in the same radio amateur civil emergency networks. All stations or station units operating in accordance with the provisions of this subpart shall be exempt from the requirements concerning station logs contained in Subpart D of this part whenever it is shown that compliance with these requirements would interfere with the expeditious handling of civil defense communications or communication drills.

(c) The current portion of the log shall be kept at the location of the operating or control position of the station or unit. Other portions of the log shall be retained by the licensee for a period of one year, at a place determined by the civil defense Radio Officer to be appropriate and advisable: *Provided*, That the logs of a station in this service shall be made available for inspection upon reasonable request by any authorized representative of the Federal Government: *And provided further*, That those portions of any log covering operation of a station in this service in connection with any actual condition jeopardizing the public safety or affecting the national defense or security shall not be destroyed unless prior approval for such destruction shall have been received from the Commission.

§ 97.211 Station identification.

(a) Stations operating in the Radio Amateur Civil Emergency Service shall identify themselves in the same manner and under the same conditions as prescribed in Subpart D of this Part, except that:

(1) Additional designators to indicate portable or mobile operation, or to indicate operation at a location other than that specified in the station license, shall not be used.

(2) When engaged in network operation, after a station or unit has been fully identified at least once, further identification by that station or unit may be accomplished by the use of abbreviated call signs or other distinctive signals prescribed by the civil defense Radio Officer in lieu of the call signs otherwise required to be transmitted by that station or unit. A record of such abbreviated call signs or other distinctive signals shall be maintained by the Radio Officer and shall be made available for inspection upon reasonable request by any authorized representative of the Federal Government.

(b) When two or more separate units of a station, which is authorized to be operated in the Radio Amateur Civil Emergency Service, are operated independently at different locations, each unit shall separately identify itself by the addition of a unit number at the end of its call sign. When transmitting by telegraphy such additional identification shall immediately follow the basic call sign and to avoid confusion with portable or mobile indicators, shall not be separated therefrom by the use of the "slant" or fraction bar, or other punctuation mark or symbol.

§ 97.213 Tactical call signs.

Stations operating in this service, and independent units of such stations, may be assigned tactical or secret call signs by the Commission or by competent civil defense authority, and may utilize such tactical call signs in lieu of the call signs appearing on the station licenses when such use is directed by competent civil defense authority: *Provided*, That a list of all such tactical call signs assigned stations under his direction shall be maintained by the civil defense Radio Officer and shall be made available for inspection upon reasonable request by any authorized representative of the Federal Government: *And provided further*, That when such tactical call signs are intended to be used at times other than during communications in connection with actual or impending conditions which appear to jeopardize the defense or security of the United States, a list of such tactical call signs and the stations or units to which assigned shall be furnished the Commission prior to such use.

USE OF STATIONS

§ 97.215 Limitations on use of stations.

(a) No station authorized to be operated in this service other than a control station as defined in this subpart, shall be operated for the purpose of transmitting any signal, message, or other communications except with the permission and under the operational control of the control station of the network in which it is operating: *Provided*, That nothing in the foregoing shall be construed to prohibit the transmission by any station or unit of a station of such signals as may be necessary for the purpose of alerting or making contact with the control station of the network, or for the purpose of transmitting actual emergency civil defense communications if the control station is disabled or is otherwise inoperative.

(b) Nothing in this section shall be construed to prevent the operation of a station which is authorized to be operated in this service for the purpose of brief tests or adjustments during or coincident with the installation, servicing or maintenance of such station: *Provided*, That the transmissions of that station during such tests or adjustments shall not cause harmful interference to the conduct of communications by any other station.

(c) No station in this service shall be used to transmit or to receive messages for hire, nor to transmit communications for material compensation, direct or indirect, paid or promised.

§ 97.217 Hours of operation.

Stations in this service may be operated at such times and under such conditions as may be prescribed by the Communications Officer or other responsible official of the civil defense organization having jurisdiction over the area which the station will serve: *Provided*, That the communications of such stations shall at all times be in accordance with the permissible communications authorized in this subpart.

§ 97.219 Points of communication.

Stations in this service may communicate with each other, with stations in the Disaster Communications Service, and with stations of the United States Government which are authorized to exchange communications with stations in this service by the particular agency having control. In addition, stations in this service may communicate, for the purpose of exchanging civil defense communications, with any other station in any service provided by the Commission's rules, whenever such station is authorized to communicate with stations in the Radio Amateur Civil Emergency Service by the provisions of the Commission's rules governing the class of station concerned or in accordance with the provisions of § 2.405 of this chapter.

TO BE CONTINUED NEXT MONTH

the ATV raster

Terry Fox WB4JFI
3612 Barcroft View #302
Baileys Crossroads VA 22041

ATV may be the most exciting "new" facet of amateur radio. The word new is emphasized because ATV has been around for over 25 years. As a matter of fact, hams were among the pioneers in television, both color and black and white. Unfortunately, except for a few isolated pockets of activity, ATV has never really caught on.

Two major reasons for this come to mind. First, there seems to be a fear of television by amateurs, both in terms of cost and knowledge. Most of the hams I talk to think that ATV is going to cost a mint. In further columns I will describe how to cut corners in assembling an amateur television station. As far as knowledge goes, television really isn't hard to understand if you take it a little at a time and use the right sources of information. Probably the best book that I have seen so far is Photofact's *Television Course (No. 20595)*. It doesn't use large words or fancy terms that take an engineering degree to understand.

The other major reason ATV isn't too popular seems to be because of the bandwidth (6 MHz or more). ATV is limited to the 420 MHz band and above, with inherently shorter range. In addition to this, at least in the Washington DC area, there are a lot of tall buildings, which tend to limit the range even more. As if that weren't enough, quite a few of the ATV enthusiasts live in apartments, and as a consequence of this ATV here has started up and died several times.

An idea that we have come up with to combat this is an ATV repeater. It's in and out frequencies are 439.25 MHz and 427.25 MHz respectively. These frequencies are already set aside for ATV in our area. The machine itself is already installed and operable. As usual the holdup is with the FCC. The repeater application itself has already been approved, but we have to file a special request for a waiver because of the frequencies involved. It seems, for some obscure reason, repeaters are allowed only in the 442-450 MHz section of our 420-450 MHz band. This portion of the band is already being used for FM repeaters, FM simplex channels and control links. In addition, since we are talking about television, the total bandwidth involved is about 12-16 MHz. It's kind of hard to put this in an 8 MHz slot.

The repeater is being supported by a new club called Metrovision. It was formed last September by a group of hams trying to establish ATV here in the Washington area. In addition to keeping the repeater operating Metrovision is also helping local hams find equipment and helping them to get it working after it has been found. We are also giving talks to area radio clubs. Since we are a new group we cannot handle many requests from outside the DC area, so what I hope to do is answer many of these questions in this column.

Each month I will describe parts of the repeater, some of the easiest ways to get on ATV, station accessories, and discuss ideas and comments sent in to me by others. Hopefully, when we show how simple it is to get on ATV more hams will discover this exciting mode.

An ATV repeater is a little mind-boggling when you stop and think about it. Instead of trying to describe your latest home project or addition to the family you just set up the camera and show it to your friends. Community projects are limitless, from televising local parades to hospital patients, to visual coverage of area wide disasters with mobiles and portables. Instead of having to hear someone else's report on the usual traffic jam during rush hour you can *see* exactly what it looks like. How about when Bell Telephone has their *Picture-Phone* available inexpensively, being able to see into your home from your car via the repeater's videopatch. Another idea that comes to mind is to link several repeaters together via microwaves so that someone can actually see whomever he is talking to in another city many miles away. The possibilites are limited only by ones imagination (and maybe the FCC). It is interesting to note that, according to reliable sources, the FCC cannot monitor ATV because they cannot afford to get the necessary video equipment!

In case you're questioning the above, mobiles and portables are possible. In fact, the repeater isn't even on yet and we already have two mobile ATV stations capable of going on the air! One is Mike WB4DVD and the other is me. Incidentally, many thanks to Bruce WB4YTU, the Metrovision station trustee, who has done most of the work on the repeater.

As you can see there are many possible uses for ATV, and it isn't as hard as it sounds to get on. There are quite a few topics that can be discussed in future columns, but the most important topics are the ones that you want to hear about. So, please write and tell me what you want to see. Also, I'm looking for good ideas and tips to pass on to readers.

Until next time, BCNU on 439 ATV.

FLASH!

On January 25, our repeater license arrived from the FCC with a six month waiver to use 439.25/427.25 MHz as our input and output frequencies. Our call is WR4AAG.

WB4JPI

W2NSD continuted from page 3.

regulations affecting amateur radio should be gotten to the amateur magazines. Ways in which amateurs can help situations should be gotten to clubs and club councils via newsletters. Tape cassettes for club programs could fill amateurs in on what is happening and how they can help. These could be played over the air via repeaters and by official news stations. In this way the response of amateurs to threatening legislation could be organized and better use made of Congressional pressure.

And what would such a Utopian setup cost us? About $100,000 per year would do a fine job, and that would include everything. That's less than 50¢ per licensed amateur per year. Is there any amateur who would not put up that much to keep the hobby healthy?

220 MHz?

No word yet from the Commission on 220. There has been some talk, in view of the stiff fight put up by the amateurs, particularly through Congress, of going the Hobby Band route. Boy, oh boy, do we need a lobby in Washington! So much of the decisions on these things is involved with politics rather than reason.

A lobby in Washington would make mince meat out of these attempts to slice up our bands and take them away. They would not only keep their finger on the pulse of the FCC, finding out where the pressures are that are zinging us, but they would be in touch with Congress and they would let amateurs know, via the ham magazines, where they could help.

73 MAGAZINE READERS CAN SAVE $200,000,000 IN TAXES

The readers of 73 Magazine will pay in about $200,000,000 in estate taxes at the current rate of taxation. It is very patriotic to support your government and all that, but as far as I can see every dollar of that can be saved for your family. The chances are that they might be able to make better use of it, if you've taught them anything.

The old saying that there are two things you can't avoid – death and taxes – may not really hold water. And that goes particularly for death taxes. Unfortunately I don't have any hot information on how to avoid death indefinitely, but there are some ways of avoiding taxes. Legally.

One of the best books on the subject is published by the National Council to Eliminate Death Taxes Inc., Rts 2, Bovey MN 55709, and costs $9.95. This book explains the whole situation in detail and guides you through most possible contingencies. While the book does not eliminate a lawyer from the deal, it does explain how to locate the type of lawyer you really need, how to bargain with him, what the service should cost, and it takes the mystery out of the whole business.

The book not only covers dealing with the IRS, but also with your state laws. The laws of every state are in there, along with instructions on how to cope with them. That could save your family another bundle, over and above the IRS savings. . .unless you want the IRS and the state to make out like bandits when you leave us. That could add another $50,000,000 to the $200,000,000 above.

NEED TAX HELP? CUT YOUR THROAT

Two letters arrived in the same mail recently, one from the IRS with the below ad and the other, a confidential one, from a reader who had been innocent enough to use the IRS tax advisory service.

I hesitate to give the details of the reader case because I don't think you'll believe me. You'll think that this one Wayne Green made up because it just isn't possible. Well, here's the story, sent in by a ham that I've known for many years.

This chap, who had a small radio business, went to the local IRS office and the agent there helped him make out his tax papers. There was one item which was questionable as a deduction. . .the tax would have been about $12 on it. . .the agent decided that it was indeed deductable. The papers were sent in and the tax as calculated by the agent was paid.

About seven months later two agents walked into his store and said that he owed the $12 plus interest plus a $50 fine for not listing the item as taxable. He went with the two agents to the local IRS office and found the agent who had made out the return. This agent remembered the item and told the other two agents that if the item was not going to be accepted as deductable that no fine should be imposed and only the $12 charged, plus interest.

The agents said they would get in touch with Washington and get back. A couple of days later they came back with the news that the $12 plus interest was due immediately, plus the $50 fine. . .and if it wasn't paid in two days there would be another $50 fine added to it. He paid the $12, plus 48¢ interest, plus $50 fine, and thought he had a good idea of where Hitler's associates had gone when they bombed out in Berlin.

"GETTING" THE MAFIA

The IRS was set loose on organized crime when law enforcement authorities found themselves helpless to cope with it. The IRS has racked up an impressive history of "getting" these people. Unfortunately, once you give an organization the power it needs to tackle something as big as organized crime, how do you stop it from using this mighty weapon on average taxpayers? Unfortunately the answer is that you don't stop them and the same illegal methods of investigation and prosecution are being used today to trample small business and the little man.

Many of the 73 readers work in electronics industries, including those which specialize in surveillance and secret communications. These readers report that the IRS is a leader in buying sophisticated secret equipment of the very latest type and that cost is no object. How many Mafia chiefs have they put away recently? They don't seem to bother these fellows much now that they have high priced lawyers and accountants to protect themselves. This has meant that the IRS agents have had to turn to the small businessman to keep his quota of collections high enough to be promoted. Where there is a demand for collections, you can be sure that no agent is going to fight tough opponents when there are saps to be hit instead.

need
tax
help?

Call IRS toll free

No matter where you live, you can call the IRS toll free for tax assistance. To find the toll-free IRS number for your area, check your tax instructions booklet or your local telephone directory.

Department of the Treasury
Internal Revenue Service

IRS TERRORISM

In an article in the American Mercury Dorothy Gordon tells of the nightmare of her dealings with the IRS. She reports that the IRS decided, with no proof offered, that her husband owed extra income taxes. Agents suddenly appeared at their home and attempted to seize a car (which did not belong to Gordon). Gordon then got in the car and drove it away, forcing the agents to move their car which blocked the driveway.

The agents then backed up a tow truck and towed away a '59 Ford belonging to Gordon's son. They told Mrs. Gordon that they were Federal Marshals, but later it turned out that they were merely IRS agents. When she demanded that they leave they threatened her with arrest. Her daughter tried to get her school books out of the car as they were taking it away and they threatened to arrest her–she never got her books or clothes from the back seat.

One of the agents told Mrs. Gordon that the IRS was out to "get" her husband and would use any means and would take everything they owned. They charged him with assault with a dangerous weapon (the car with which he forced the agents to move out of the way was the dangerous weapon) and had him arrested. Gordon was enthusiastic about this for he thought he would then get a jury trial and have his chance to speak up. The court refused him a jury trial and, when he insisted through three pre-trial hearings, they decided to commit him to a mental hospital.

When Gordon got word that the plans were to put him away and that six tough agents were scheduled to beat him on the way to the mental institution, he escaped to Canada, where he is now living in exile.

This happened in Massachusetts.

KICK A CRIPPLE

In Nevada a woman was living with a fellow, but not married. One day this chap had the misfortune to get caught with a big bundle of pot. The IRS has a tax on pot, even though it is not legal to sell the stuff. The IRS then claimed that the chap owed $500,000 in pot tax on the confiscated pot. The fellow had one more misfortune – he and his girl had a car accident which killed him and put her in a wheelchair for life. The woman didn't have much except a small home, but she figured that she would be able to sell it and invest in a small business that she could run from her wheelchair. The IRS then claimed that she was the common law wife of the now deceased defendent and laid the $500,000 tax claim on her. They took her house and auctioned it off and left her with nothing to do but go on welfare for the rest of her life.

An ex-IRS agent, in an interview in Freedom Magazine, explained how he could get anything he wanted from banks as an IRS agent with his pocket subpoenas which he carried with him. He would fill one out on the spot to examine any bank records or go into safety deposit boxes. They would even have to drill open the boxes for him!

The ex-agent explained how the IRS is often used to "get" people whom politicains want to harass. The word would always come down verbally, nothing written, and the agent was told to stay with the case until something was found. He went on to say that there isn't a return in the world that an agent can't find something wrong or even change to trip up a taxpayer.

The ex-agent also said that the IRS will assign special agents to pose as regular agents when they are trying to build up a case of fraud so that the taxpayer has no idea he is being investigated for fraud.

Knowing that the large corporations can put up a fight, and that it is worth their while to fight, the IRS goes after small business and the little guys who have no such legal protection. Big business also has the political clout to keep the IRS agents away.

Senator Cotton (NH) said, "My files, like those of every other Senator, are filled with moving appeals from taxpayers whose experiences with the IRS have turned into nightmares of inquisition."

IMMEDIATE CHANGE

One serious defect in the present system of "justice" for IRS persecuted little people is the secret grand jury system where the whole proceedings are carried on behind closed doors and no records whatever are kept. This was set up to protect witnesses against organized crime repraisal, and it is good for that purpose, but is it reasonable to use this same system against ordinary taxpayers?

At the very, very least there should be some arrangement for an attorney for the accused to have a chance to answer questions that the grand jurors might have. As it is now an IRS agent can go before a grand jury and say absolutely anything he wants, knowing that there is no record kept and thus he is totally unaccountable to anyone. Since he is the one who wants an indictment, there is nothing to prevent him from perjuring himself to almost any length except his own conscience. On the other hand there is the pressure from the higher ups in the IRS to get a conviction.

What could it possibly hurt in nonorganized crime cases to permit the grand jury to ask the defense counsel questions? Even if the defense counsel had no way of knowing what the agent had testified, this certainly would be helpful to the grand jury in performing their function. The present system where the defense is not present at any time, and cannot be consulted, is extremely unfair.

Why can't the defense be present? Well, the idea is to keep back as much of the case as possible until the actual trial so as to prevent the defending lawyer from being able to prepare a defense. This is very important in tax cases where almost unknown regulations are involved which would take long periods of time to look up. There is no intention of having a fair trial which will try and find out whether the defendent actually did do anything illegal, only a test of lawyers trying to outwit lawyers, paid for by the government on one side and the poor taxpayer on the other.

JORDAN TOUR POSTPONED

Due to the continued tensions in the mideast, it seems prudent to put off the planned ham tour of Jordan. Once things have settled down a bit and Kissinger is back stateside for awhile, such a trip might be a little more fun.

GET WAYNE GREEN?

Another reader, who prefers to remain anonymous, advises that a friend of his in the FCC Washington office has informed him that someone there is doing his best to make problems for me. He says that the staff has been asked to look carefully into my "portable one" call and the validity of its use. Well, that isn't really a surprise since Walker threatened me with that over a year ago.

97.43 says that every amateur station shall have a fixed transmitter location. The fact is that I do have such a location and it is in Brooklyn, New York. . .and has been since my family moved there in 1909 from Denver. It would be difficult to find a more fixed location for me. Oh, I've lived for a while here and there, renting a room or even an apartment for a bit. I tried changing my ham license as I moved around for a while, but the FCC was always at least one move behind me. I just barely got my W4NSD call when I was back in Brooklyn and active as W4NSD/2. Then I went to work in Ohio for a while and operated as W2NSD/8 while the machinery at the FCC creaked along. . .I remember operating the first weekend of the Sweepstakes Contest as W2NSD/8 and racking up a great score. The next weekend I had my new call, but I was back in Brooklyn and I operated in the second weekend of the contest as W8NSD/2!

Then it was Florida and W4NSD again. . .then W4NSD/2 back in Brooklyn. I didn't even try when I was W2NSD/5 for a summer. . .for I could see that the only really permanent location I had was in two land. Besides, the FCC decided to stop giving counterpart calls. . .they couldn't be bothered any more with this.

Message to Walker: If you can't justify the rules you've been jamming down our throats, are you going to try and shut up the *only* editor who has the guts to speak out?

97.97 gives us the rules for portable operation and I have filed my notice of portable operation as specified in the regulations. The fact is that after being NSD for some 35 years I do like it and would prefer to stay that way if it is possible. . .and the rules seem to make it legal. Of course if Walker would act on RM-1455, which was filed back in mid-1969, almost five years ago, then we might be back with counterpart calls again and W1NSD would be available. That's probably what will happen just about the time I return to Brooklyn.

EMERGENCY PREPARATIONS

It is not enough to have your repeater set up for autopatch for reporting accidents to the gendarmerie. With any real bad luck you'll need something more elaborate to meet the situation.

If your repeater group is going to be able to cope with something substantial in emergencies, you'll need both direction and experience. Too bad if you wait for the disaster to try and develop these basics. Perhaps, at the next meeting, an emergency coordinator could be appointed or elected. This person would have the responsibility of arranging for the group to be ready for the biggie, when it comes.

The EC should get his notebook set up with the phone numbers of all club members, with a list of the equipment they have which might be of value such as spare rigs, mobile setups, hand units, power generators, things like that. He'll want to have the numbers of other local radio services and groups . . . radio and TV stations . . . police . . . fire . . . ambulance . . . forestry . . . road agents . . . public service . . . anyone or group you might need to contact in emergencies . . . hospitals . . . doctors . . . garages . . . as well as a contact with each of the other two-way radio communications services in the area . . . doctors . . . sheriffs . . .

The EC can get together with police or the fire department and set up an exercise to provide training for the group. In this way a minor emergency can be used as practice. Some groups use parades, rallies, and things like that to get experience in getting out the troops and getting everyone used to working together.

Your own imagination can take it from there.

STATION VS. OPERATOR LICENSES

There is a tendency in dealing with problems. . .and most problems stem from people. . .to try and dehumanize the situation and deal with it that way. When we get interference on the air there is a tendency to think of it as being a sideband station — an RTTY station — and on FM there are base stations, mobiles, and the like. "Let's keep the base stations off the repeater," you'll hear some voices cry.

The time is not long past when the FCC reinforced this concept with the license. It was the location that was licensed with call letters, not the operator. The operator license was separate and had no call letters on it. The FCC followed this further by insisting that no operator use the call letters of the station being used.

Recently the Commission has turned this around. We have one license now and it serves as both a station and operator license and the concept of the operator having the call rather than the location has been accepted. Now, when you use another station you normally are supposed to use your own call.

Perhaps it will help us to deal with difficulties on the air if we keep in mind that those are all people out there — each one an individual — each with his or her own interests and goals — each worthy of knowing (with a few exceptions). Is a person of less interest to talk with if he is sitting at home than if he is in his car? In fact it is generally the other way around, for the mobile operator has a good part of his attention on his driving and the chances of anything much more than total trivia emerging from the contact is miniscule. At least the home operator (called a base station operator by 10-4 adherents) can devote his entire attention to talking with you.

Admittedly the mere fact that communication is possible is worthy of note, but is this any reason to devote such a large portion of the use of the amateur bands to this topic? On the low bands an inordinate proportion of the average contact is spent commenting on the signal strength, the equipment used, and other things having to do with the mechnaical aspect of making the contact. How much time is devoted to the human being at the other end? How much time is spent using this marvelous electronic invention for a way to communicate thoughts? The same observation holds for repeaters.

450 MHz UNDER FIRE

Backed by exciting television shows, the emergency medical services are making a play for more UHF spectrum (Docket 19880) and one of the things they want is the top two MHz of the 450 amateur band. Just to make it binding they have initially asked for three channels in this band for immediate allocation.

220 MHz, which had not yet become much used, was one thing — the 450 band, which is full to bursting in many areas of the country, is something else. To my mind every kHz is precious and should be zealously guarded. Before FM became popular on two meters the 146-148 MHz segment of the band was virtually unused and one ham magazine was seriously talking about opening that as a CB band — and the industry was listening. FM came along just in time to make that idea unpopular. We can't go along living as if there is no tomorrow.

If crossband is permitted for repeaters we will see a great need for 220 MHz channels and the 450 frequencies will be used up everywhere. Even 1250 MHz will soon come into popularity.

Some recent developments in narrow band television show fantastic promise for that mode and we may soon see repeaters for this mode starting to proliferate. It now appears as if a television signal of good quality may be compressed to 100 kHz, which is a good start, and certainly practical for repeater use. We could get 100 of those channels between 420-430 MHz!

And those are only the things that we can see coming. We should leave some room for things that are not yet obvious.

BUYING CASSETTES

The 73 Magazine code cassettes have been incredibly popular, and that has produced problems, naturally. One of the weird ones has to do with getting blank tape cassettes. There shouldn't be any problem with that, right?

First we wrote to every known manufacturer of cassettes asking for prices. About 20% of them bothered to answer. A few did send prices, and a couple even sent a salesman. The next step was to try and get the best price we could, and there is where frustration really set in. Would you believe that we found that we could go down to a discount store in Peterborough, New Hampshire and buy cassettes cheaper over the counter than we could in 1000 lots from the manufacturer? Fact. And you should see the eyes pop when we walk up to the counter and ask for 1000 cassettes! And you would die laughing as the checkout girl dutifully rings up each cassette individually, resulting in a tape yards long. Weird.

HOT NEWS FOR RTTYers

Owners of RTTY machines are missing a lot of the fun of owning such a contraption if they don't tune it in for the latest news dispatches now and then. Some of the news channels are difficult to find in amongst all of the other debris that clutters up the short wave bands, but you might try some of the following and see how you make out. Most of them use the standard 425-850 Hz shift and 60 wpm speed.

8PX29 Barbados	6910 kHz
WFI29 New York	9327.5 kHz
WFK80 New York	10753.5 kHz
WFL71 New York	11641.5 kHz
WER73 New York	13480 kHz
WER24 New York	14770 kHz
WFM75 New York	15706 kHz
WEY45 New York	15914 kHz
WFK48 New York	18542.5 kHz
WER78 New York	1885.0 kHz

A much more comprehensive list of commercial RTTY stations as well as a whole raft of other confidential frequencies is available from Gilfer Associates Inc., Box 239, Park Ridge NJ 07656. The book is the "Confidential Frequency List" and it is $3.95.

Caveat Emptor?

Price – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor . . .

DAYTON HAMVENTION expands to three days April 26, 27, 28, 1974 at HARA ARENA and Exhibition Center. Brochures mailed March 15th. Write for information if you have not attended the last two years. P.O. Box 44, Dayton, Ohio 45401.

SWAN CYGNET-260, SSB built in AC/DC, excellent condition., Factory overhaul $275. Regency HR-2A, 15W. FM with 52/52, 94/94, 04/64 installed, factory carton, mint condition $160. K4HHH/6, P. O. Box 81652, San Diego CA 92138.

PRINTED CIRCUIT TECHNIQUES FOR THE HOBBYIST. Ferric chloride "suspension etching," cutting epoxy glass, screen printing, etc . . .BOOKLET $2. TRUMBULL' 833 Balra Dr., El Cerrito CA 94530.

THE TRI-STATE ARS WILL hold their annual hamfest on May 18, 1974, at the 4-H fairgrounds, U.S. 41, three miles north of town. Overnight camping, auction, flea market, door prizes and ladies bingo. For information or advance registration contact: Steve WB9MDB, 5805 Berry Lane, Evansville IN 47710.

GOOD NEWS – The SRRC Hamfest June 2, 1974 at fabulous new site in Princeton, Illinois Fairgrounds. SRRC/W9MKS, RFD No.1, Box 171, Oglesby, Illinois 61348.

WANTED – Technical manual for R-278B/GR military receiver. WB5AYZ, 1013 Indiana St. SE., Albuquerque NM 87108.

FM: TOUCH-TONE PADS, 12 button – $13.99 plus 50¢ postage. New Regency HR-212, w/AC supply $269.95; HR-2B, w/AC supply $239.95. Tempo, Gladding, Cush Craft, etc. Call or write for lowest prices anywhere. Used Gladding 25, w/AC supply – like new $169. Ramcomm Communications, 2383 West Side Drive, North Chili NY 14514 716-594-8114.

EQUIPMENT FROM 73

The following list of gear, unless otherwise noted, consists of brand new equipment purchased for testing purposes only. Some have been tested, some remain unopened in original cartons. We are offering this gear at a considerable discount on a first-come-first-served basis. Please send Money Orders or Certified Checks only to 73 Magazine, Peterborough NH 03458.

Cap Com 40M solid state SSB xcvr	$150.00
Gladding 12V power supply	$60.00
SBE Scanavision	$650.00
Midland 13509 220 xcvr	$200.00
Tempo CL-220 220 xcvr	$200.00
Clegg FM-21 220 xcvr	$255.00
TME-H-LMU 16 channel rcvr	$255.00
Digital logic-clocks	$80.00
Wilson 7 element 10 and 15M beam pick up only	$250.00
Waller 60A power supply	$105.00
Pickering KB-1 keyboard	$200.00
Heath HWA-202-1	$30.00
Heath HA-2022 amplifier	$70.00
Gladding HI Scan	$150.00
Regency TMR-8-U Scanner	$140.00
Tempo fmh charger	$25.00
GTX-2 FM rcvr	$225.00
Newsome 2M KW amplifier	$350.00
Heath IC-2009 calculator	$90.00
SBE 450 FM xcvr	$340.00
Mits 908M w/ac and case	$130.00
Memory Matic 8000	$320.00
IC-30	$350.00
IC-60	$300.00
AX 190 amateur xcvr	$200.00
Pickering KB-1 keyboard	$200.00
SBE-450 FM xcvr	$340.00
GYX-200 (slightly modified)	$200.00
Heath 1B-101 counter with Vanguard scaler	$250.00
Standard SRC-120/5 power supply	$44.00

DIGITAL frequency display for your receiver and transmitter. Also works as conventional counter. Detailed plans $3. Communications Electronics Specialties, 814 Orwell Ave., Orlando FL 32809.

FAX PAPER: For Desk-Fax, new (not surplus), precut (not rolls), $15 per thousand sheets, postpaid worldwide. Bill Johnston, 1808 Pomona, Las Cruces, New Mexico 88001.

MOULTRIE AMATEUR RADIO KLUB, 13th Annual Hamfest, Wyman Park, Sullivan IL, April 28, 1974. Indoor – Outdoor market. Ticket donation $1 in advance – $1.50 at the door. For information write: M.A.R.K. Inc., P. O. Box 327, Mattoon IL 61938.

WANTED – MANUALS ON FRR-33, CU-286/FRR-33, ARC-96, TT-513/FR, R390A operator's manual. Xerox copies OK. Call 603-673-1948 collect.

FREE: 18 CRYSTALS of your choice with the purchase of a new Genave GTX-200 at $269.95. Send cashier's check or money order for same-day shipment. For equally good deals on Drake, Swan, Standard, Clegg, Regency, Hallicrafters, Tempo, Kenwood, Midland, Ten-Tec, Galaxy, Hy-Gain, Cush Craft, Mosley, Sony and Hustler, write to Hoosier Electronics, your ham headquarters in the heart of the Midwest. Become one of our many happy and satisfied customers. Write or call today for our low quote and try our individual, personal service. Hoosier Electronics, R.R. 25, Box 403, Terre Haute IN 47802. 812-894-2397.

BUY-SELL-TRADE. Write for monthly mailer. Give name, address, call letters. Complete stock of major brands, new and reconditioned equipment. Call us for best deals. We buy Collins, Drake, Swan, etc., SSB & FM. Associated Radio, 8012 Conser, Overland Park, Kansas 66204. 913-381-5901

CASSETTE TAPES wanted, any quantity, any quality, new or used, as long as they are in good working order and a bargain. Write Box BM, c/o 73 Magazine, Peterborough NH 03458.

CALCULATOR OWNERS: Use your +-x÷ calculator to compute square roots, cube roots, sin(x), cos(x), tan(x), arcsin(x), arccos(x), arctan(x), logarithms, exponentials and more! Quickly, accurately, easily! Send today for the IMPROVED AND EXPANDED EDITION of the First and Best Calculator Manual – now in use throughout the world. . .only $2.00. Unconditional moneyback guarantee – and FAST service! Mallmann Optics and Electronics, Dept. - E3 836 South 113, West Allis WI 53214.

GREATEST of them all! That's the ARRL 1974 National Convention, sponsored by Hudson Amateur Radio Council. Remember the dates – July 19, 20, 21 at the Waldorf-Astoria, New York City. Three days of exciting events!! Wide array of demonstrations, exhibits and forums featuring latest in FM, SSTV, ATV, RTTY, FAX, Satellites, Antenna design, Transistors, Integrated Circuits, DX, MARS, ARPSC and much more. Something to do every exciting minute for YLs & XYLs – Tours, New York sightseeing, visits to popular TV shows, Parties, Fashion Shows. Meet the ARRL President, Vice-presidents, and all 16 Directors! Famous-name Speakers at Saturday Night Banquet! Everything for the Non-Ham, New Ham and Old Timer. For Info, Contact: ARRL Convention, 303 Tenafly Road, Englewood, N.J. 07631.

WANTED: Popular Electronics issue on VLF transmitter NPG, Jim Creed, Washington. Early Sixties. H. A. Weber, 2605 West 82nd Place, Chicago IL 60652.

CURTIS ELECTRODEVICES and Madison Electronics present the finest in CW devices: EK420A CMOS Deluxe Keyer $139.95; KM410 CW Message Memory $299.95; KB4200 Keyboard Morse Generator $499.95; Write Literature. Brown and Vibroplex Paddles; UPS Collect. Madison Electronics, 1508 McKinney, Houston TX 77002. 713-224-2668; Nite – 713-497-5683.

VERY INTERESTING! Next 5 isues $1. "The Ham Trader", Sycamore, IL 60178. (Ask about our "HAM EQUIPMENT BUYERS GUIDE" covering Receivers, Transmitters, Transceivers, Amplifiers 1945–74. Indispensable!)

MOBILE IGNITION shielding gives more range, no noise. Everything from economical suppression kits to custom shielding. Literature. Estes Engineering, 543-A West 184th St., Gardena CA 90248.

FOR SALE: Drake 2NT transmitter, Heathkit VFO, one year old, perfect condition $140. Richard Newman, 2 Clinton St., Milford CT 06460 203-877-2205.

WANTED – UG-970/U Twin -UHF adapters for R-390A/URR; other surplus RF connectors. Best prices paid. Send details to Hampstead, P. O. Box 185, Milford NH 03055.

FOR SALE – AN/FRR-33 (SRR-13) 2-32 MHz receiver in good condition with book, $85, freight prepaid in U.S., John Sullivan, Box 185, Milford NH 03055.

FOR SALE – PAIR AN/PRC-25 portable FM transceivers, 30-74 MHz synthesized, like new with antennas, book, handsets and 1 AM-2060A/GRC audio amplifier/speaker/power supply/mounting base for mobile use, $300 takes all, UPS prepaid in U.S. 603-673-1948 collect.

FOR SALE: 432 HANDIE TALKIE SR-C 432 2 watt 6 channel with case $270, 2m Handie Talkie SR-C 145B 2 watt 5 channel with case all new $230.. Joe Gibson, P. O. Box 442, Wallingford CN 06492.

MOTOROLA PORTABLES – Expert repairs, reasonable prices, fast turnaround time. More details and flat rate catalog FREE. Ideal Services, 6663 Industrial Loop, Greendale WI 53129.

G.E.MASTROWNERS, add five channels the easy way! Drilled board and instructions $4.50. SASE for information to J. Jones, 1310 West 29th St., Lorain OH 44052.

FM RECEIVERS' R-257/U, 25-55 MHz crystal controlled, some need repairs. Schematics included while they last. These were $14.95 plus shipping; NOW ONLY $8.95, 2 for $15, shipped PREPAID 48 states. Other items, especially RTTY and FAX. SASE for free list. Jim Cooper W2BVE, P. O. Box 73-G, Paramus NJ 07652.

LOOKING FOR DESK STAND for W.E. 600A double button carbon broadcasting type professional mike. . .Jean Shepherd K2ORS, WOR, NYC 10018.

WANTED SCHEMATIC for DAVCO DR-30 Receiver, Hughs MIM-Scope, Borrow or buy, first class postage both ways. WB4TDE/4, 516 E. Carroll ST., Tullahoma TN 37388 615-455-2815.

73, COMPLETE run for sale; want same, Ham Radio. K8JLK.

CABINETS 19" new Emcor – 72" rack space with rails and plugstrip, $70, delivered in Central and Western New York. N. Litsche, Rt. 1, Hemlock NY 14466.

COLLINS KWM-1 with ac, dc, speaker console, and mobile mount, very good condition $350. Hallicrafters HT41 linear $135, Collins 75AZ with product detector $150, Heath HW16 $75, Heath HX20 $125, Swan 240 with ac and TCU $250. Jack Osborne K6LVD. 5636 Del Monte CT. Canta Rosa CA 95405.

NORTH FLORIDA SWAPFEST March 31, 1974, Community Center, Highway 98. Write: PARC Box 873, Fort Walton Beach FL 32548.

KLM AND MADISON ELECTRONICS present the finest in VHF Antennas. 144-148 MHz, 7-element to 16-element; 9-element $31.95; 14-element $45.95; 16-element $49.95; 220 MHz; 420-450 MHz, 14-element $19.95; 27-element $41.95; Write for literature. UPS Collect. Madison Electronics, 1508 McKinney, Houston TX 77002. 713-224-2668; Nite – 713-497-5683.

CE-100V MINT w/original crate $250, or trade MN-2000, T4X-B, DR-30, DT-20. Need dow keys, coax switches, rotary inductors. WA2FQH, 89-38 188 St., Hollis NY 11423. 212-454-1369.

WANTED – **TT-63** Regenerative Repeater or AN/FGC-7 repeater set. Call 603-673-1948 collect.

FOR SALE: DRAKE R4B, T4XB, AC4, matching speaker. Excellent condition, little use, one owner, $750. TEMO I with ac/dc $400. Hallicrafters HA-1 TO keyer $50. Galaxy 300 3-band SSB transceiver with ac $125. Phil Sager WB4FDT/5, St. Mary's University, Chaminade Hall, Box 86, San Antonio TX 78284.

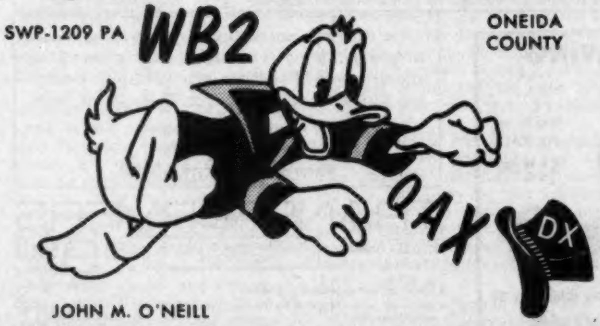
HALLICRAFTERS FPM-300 MKII includes fan, all crystals, extra final, perfect condition. Must sell $565 firm, postpaid. Charles Signer DA1SI, Box 775, APO NY 09742.

WANTED 51S1, serial above #500, excellent condition with manual, boxed, delivered to airline. State serial and condition. Arthur S. Cohen, Risco No. 437, Mexico 20., D.F. Mexico XE1LL.

19TH ANNUAL HAMFEST & Auction to be held Saturday March 9, 1974, at the Lucas County Recreation Center, 290 Key St., Maumee OH. Registration $1.50 in advance, $2 at the door. For further information and map write: Toledo Mobile Radio Association, P. O. Box 273, Toledo OH 43695.

WANT TO BUY SW broadcast receiver, Drake SW-4 or similar, David Potter, 406 E. 32, Austin TX 78705.

QSL CONTEST



Our winner this month is John M. O'Neill of New Hartford NY. Mr. O'Neill apparently found out about one of the judge's deepest and darkest secrets in life, an unabashed fanship for Donald Duck. He then took this knowledge and power and had his QSL card made up to exploit this emotional feeling of the judge's. Are there any limits to what a person will do to win a 1-year subscription to 73? Very sneaky Mr. O'Neill.

You might be as lucky as Mr. O'Neill, enter your QSL card in our contest. Send all entries to 73 Magazine, Peterborough NH 03458.

SOCIAL EVENTS

LANCASTER FEST

The second annual Eastern PA hamfest and flea market will be held at the Naval Reserve Center in Lancaster PA from 10 AM to 4 PM, March 1974. For further information write Al K4AVQ/3, 20 Lepore Drive, Lancaster PA 17602.

CENTRAL MASS AUCTION

The Central Massachusetts Amateur Radio Associations annual auction is April 20, at the Knights of Columbus Hall, Rt. 9, Spencer MA, beginning at 1:00 PM Talk-in on .94 and 37/97. For further information write: WA1FIH/1, 1622 Worcester Rd., Apt. 421B, Framingham MA 01701.

MOULTRIE KLUB

The Moultrie Amateur Radio Klub will hold its 13th Annual Hamfest April 28, 1974 in Wyman Park, Sullivan IL. Indoor – Outdoor Market. Ticket donation $1 in advance – $1.50 at the door. For information write M.A.R.K. Inc., P. O. Box 327, Mattoon IL 61938.

MIDLAND CANCELLATION

Because of the energy shortage the Midland Amateur Radio Club, has voted not to have the Swapfest this year. It was originally scheduled to be held March 23-24.

SEE YOU IN DES MOINES

The Des Moines Radio Amateur Association invites you to participate in the Des Moines Hawkeye Hamfest at the Iowa State Fairgrounds in Des Moines, Sunday, June 16, 1974, 8:00 AM to 6:00 PM CDT. Booths available for rental. For further information contact: Alan V. Harris, K0OOD, P.O. Box 88, Des Moines IA 50301.

CANTON – CAN DO

The Canton Amateur Radio Club will hold it's annual Auction & Flea Market Friday March 8, 1974, at the Imperial House Motel in Canton OH. Doors open for set-up 5:00 PM, begins 7:30 PM. Mobile check-ins on 147.06, .94 simplex and 19/79. Grand prize, mobile check-in prize, other prizes awarded each half-hour. Free coffee and donuts. Free set-up displays and exhibitions with free space. Imperial House Motel is located just North of Canton OH on I-77. Take the Everhard Rd. exit West just .2 miles. For exhibit and display reservations or additional information contact Mark Schontz WB8NUA, 601 Perry Dr., N.W., Canton, OH.

ROCKY ARRL FEST

The 1974 ARRL Rocky Mountain Regional Convention will be held June 7, 8, and and 9, at the Ramada Inn in Pueblo CO. Pre-registration fee is $6, at the door $7. Meals, accomodations and camper/trailer hook-ups will be available for the three days of the convention at special reduced rates. Sunday afternoon banquet with speakers from Industry and the Amateur Radio Field. For additional information write: Convention Committee, P. O. Box 92, Pueblo CO 81002.

BARRACKS FEST & AUCTION

The Jefferson Barracks Amateur Radio Club will hold their annual Hamfest and Auction at the Mosley Auditorium, 4610 North Lindbergh, St. Louis MO, on Friday, March 1, 1974. For further information contack: Gene Bell K0BVM, 375 CCC Road, St. Louis 25 MO.

IRVINGTON HAMFEST

The Irvington Radio Amateur Club will hold it's annual hamfest on Sunday May 19, 1974, 1-6 PM, at the Irvington PAL Building, 285 Union Ave., Irvington NJ. Admission – 50¢ in advance, $1 at the door. Table rental – $2.50. Refreshments will be available. Door prize!! For more information and advance tickets contact WA2PWZ, 9 Barbara St., Newark NJ 07105.

BLOSSOMLAND SPRING-THING

The Blossomland Amateur Radio Association will hold its Spring-Thing '74 Swap-shop and Auction on March 16, from 9-5 (set-up 7:30-9), at St. Joseph (MI) High School. Tickets are $1 in advance, $1.50 at the door. Talk-in, 22/82, .94 simplex. For more information contact: P. O. Box 175, St. Joseph MI 49085.

TRI-STATE ARS FEAST

The Tri-State ARS will hold their annual hamfest on May 18, 1974, at the 4-H fairground, U.S.41, three miles north of town. Overnight camping, auction, flea market, door prizes and ladies bingo. For information or advanced registration contact: Steve WB9MDB, 5805 Berry Lane, Evansville IN 47710.

MESILLA BEAN FEED

The Mesilla Valley Radio Club of Las Cruces, New Mexico, cordially invites you to its "Annual Bean Feed and Swap Meet," to be held April 28, 1974, at La Mesa Park. Prizes/Food/Beverages/Family Fun. Information on 16/76 and 3940 MHz. For more information contact Whitey W5ECQ.

HAMBOREE

The greater Baltimore Hamboree will be held at Calvert Hall College, Putty Hill and Goucher Boulevard, Towson MD (one mile south of Exit 28 on Beltway I-695), on Sunday, April 7, 1974, at 10 AM. Food service, flea market, prizes. Registration $2. No table or percentage charges. For more information contact: Joe Lochte, 5400 Roland Ave., Baltimore MD 21210, or Brother Gerald Malseed, 8102 La Salle Avenue, Towson MD 21204.

MAUMEE – HOW I LOVE YA

Our 19th annual hamfest and auction is to be held Saturday, March 9, 1974, at the Lucas County Recreation Center, 290 Key St., Maumee OH. Registration $1.50 in advance, $2 at the door. For further information and map write: Toledo Mobile Radio Association, Box 273, Toledo OH 43695.

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VOX POOP

Dear Wayne: See that 3¢ stamp on the envelope this is sent in? Notice how great it worked? That give you any ideas for when they raise postal rates again?. . .K4IBB. *(Sonofagun, a 3¢ Francis Parkman stamp came through no strain!. . .wayne).* The Morse Code tape is terrific; I may have it learned in a few more days. The recorder itself is a great piece of engineering for the money – you must not have made the full markup. . .Wright. *(Yes, those recorders are excellent; I like the knob operation infinitely better than the key type of machines, particularly for car operation. . .wayne).* I was in your corner, Wayne, until you began your ridiculous attack on the FCC and Walker – get off your soap box. . . W8AUV. *(Perhaps AUV is right and I'm wrong – and the ARRL directors are wrong – and tens of thousands of FMers are wrong. . .wayne).* I like the variety of ads in the magazine; would like to see an article on high power rf transistorized linear amplifiers. . . VE3EFJ. Excellent magazine; more info on Amsat. . .Albanese. Would like more RTTY articles, more Motorola and GE FM conversion articles. I find the magazine easily readable, enjoyable, and informative. . .WB2BYQ. How about a longer W2NSD/1 column?. . .WA1IML. *(Good grief!. . . wayne).* Wayne, why don't you put out two magazines. . .one for 2m FM. . .then 73 can go back to being a general amateur radio magazine. . . WA8LTY. *(Any weight toward FM is caused by articles submitted, not by editorial slanting. . .so let's see more HF articles, more CW articles, more DX articles, more gadgets. . .wayne).* Generally well balanced. My primary interest is in IC's, digital and linear. Appreciate good articles like the one on LM-373 in April 1972, for instance. . .W8VDA. Would it be possible to get more DX news? Down here any info on DX is real news!. . . ZL1VD. Would like to see simple test equipment such as fet dip meter, fet voltmeter, dual trace generator for scope, general coverage receiver, ham band receivers, improvements of receivers, application of new IC devices. . .Evans. More 2m construction projects. . .WB4YXX. Walker stinks, QST stinks, CQ stinks, keep up the good work. . .WB5FWE. *(The IRS stinks too. . .wayne).* More articles on surplus 2m. . .KL7HRU. I like the pinup front covers and circuits-circuits. . .WB6FVW. Especially liked the November cover – have more on facsimile and 2m FM equipment reviews. . .WB2ELF. Your December cover is great!!! 73 has all the other magazines beat. . .WA3UES. Wasn't going to renew, but the December cover changed my mind. Bless you, you're right on, etc. . .WB4WBP.

10m AM EQUIPMENT NEEDED

Our club is in the process of organizing a Long Island High School Amateur Radio Club Net, and 10m AM equipment is drastically needed. Our own club station is borrowed equipment, and we have no assurance we will have it next week, so we need a station of any type. Any contributions are tax deductable (monitary *or* equipmentwise).

Our club is going to be operating all day on March 22, 1974, and we will offer a certificate to all those stations which QSL. We will operate 80-10m, phone-CW-Novice. We are presently seeking special temporary station authorization and are asking for WT2CHS.

W. Tresper Clarke High School
Amateur Radio Club
Westbury NY

CORPORATE MONOLITH STRIKES AGAIN

VHF Engineering sincerely appreciates the unsolicited letter from Bob Fox K2MDM, which appeared in your December 1973, issue. However, due to greatly increased order input and requests for literature etc., we have had to make a couple of policy changes. We can no longer repair and tune kits for free. The minimum charge is now $5 each. This normally covers anything short of a completely charred and destroyed unit. Due to our "Corporate Policy" of continually striving to improve our products we have been forced to discontinue automatic mailing of update information. The volume is simply to great for us to cope with. We do try to answer *all* legitimate inquiries quickly and keep all of our customers as happy and well informed as possible. We hope that these changes will not dissapoint anyone.

In answer to Mr. Fox's question concerning the possibility that we may consider manufacturing automobiles, I can only say that there has been no serious discussion of that subject here at VHF, YET! But, when it comes to communications equipment – we're #20 (or so) and we DO TRY HARDER.

Bob Brown W2EDN
Dave Agard K2TOS
Binghamton NY

YAY! – ADVERTISER

At a time when many businesses seem insensitive to the needs of their customers, I am happy to report that just the opposite is true of one of your advertisers, Columbia Electronic Sales of North Hollywood CA.

I recently mailed them an order for some ARC-5 surplus gear which I read about in an ad in 73. When the stuff arrived, one of the pieces was not what I had ordered, but rather something similar in outward appearance but completely different internally and practically useless to me.

I wrote to Columbia explaining what had happened and asked for a rectification of the mistake. Almost by return mail I received a reply from Mr. Paul Keys of Columbia, stating that the correct item was in the mail. He made no request that I return the incorrect item originally sent – as you know, postage on some of these things equals or exceeds their worth. Today I received the item originally ordered – exactly two weeks to the day from the time of the mailing of my original order. That's fast service. I might point out, also, that all this was done for a very small order. It's almost a certainty that Columbia lost money.

John Grahl WB0CAW/7
Pocatello ID

HE LIKES US

The free and easy style of your magazine is in sharp contrast to some other amateur periodicals which tend to be a little too formal and a bit stuffy. 73 makes for enjoyable reading and since this is still a free country (in spite of some recent FCC rulings) the readers can disagree with portions of the editorial comments without the possibility of facing a firing squad. I suppose editorials with which all readers agree would make for very dull reading. Keep blazing away – most of us like it.

Solid state projects appearing in 73 are particularly enjoyable to me. I have one suggestion which would simplify construction of many of these items. Where printed circuit boards are used a full sized layout diagram is much to be desired. These diagrams can be clipped out, fastened to the copper clad board, and holes drilled at the connection points. It is then a simple matter to complete the layout on the copper surface using resist material or for a neat job the tape donuts and strips are ideal. For instance, peel backing off one of the small donut pads, stick a pin through the hole. Then, use the pin to center the pad over the pre-drilled hole in the board. Line connections are then easily made using the tape strips. If a number of the same layouts are needed several layers of PC board can be taped together and drilled simultaneously or an aluminum template can be made.

W. E. Byron WB4PKR
Pensacola FL

SIGNAL/ONE

I have just read your editorial comments concerning Signal/One, Ed Jay, etc. Thought you might be interested in publishing the following concerning the new company (Signal/One, P.O. Box 127, Franklin Lakes NJ 07417).

The assets of Signal/One Corp., were purchased in the California courts and have since been moved to Franklin Lakes NJ, where the new CX7B is being developed and will be marketed in late spring of 1974. The new company is incorporated as Signal/One of New Jersey and headed by Don Roehrs WA2SAB, who is President and General Manager. All the stockholders are residents of the East Coast, including Don Payne K4ID, of Payne Radio, who will be the exclusive distributor of the new Signal/One products. The parts and service department is already open to owners of all CX7 radios.

There is absolutely no relationship or ownership by any of the defunct California Corporation stockholders or employees.

The new CX7B will be introduced at the Dayton Hamfest on April 27, and will include extensive engineering improvements.

Don Payne K4ID
Springfield TN

HOORAY – HAPPY READER

Hooray for Ronald Murray VE4RE. His article in the January 1974, issue of 73 was basic, simple and very helpful to the newcomer and the not so new person in amateur radio.

I very strongly feel authors (and publishers) blow off the chest and the mouth by writing and publishing technical articles that only electronic engineers can (maybe) understand. This is fine for those interested parties and the prestige of the magazine, but I beseech you to not forget the amateur amateur, like myself. Our needs are very seldom met.

Informative articles that remain basic and noncomplex throughout the length of the discourse would provide some building blocks for the advancement and progress of many hams.

Leo A. Boron WA8SYA
London OH

FIGHT LUNG CANCER SUBSCRIBE TO 73

73 Magazine has many qualities that I admire, but unlike the others that cross my desk, it doesn't have any cigarette commercials. . .hi!

I know the other ham magazines don't carry them either, but they might someday. . .and I hope you hold out against "blood money." Raise your subscription price, or anything else, but let's keep lung cancer out of our hobby.

Andy Anderson K6BBQ
KCBS Radio
San Francisco CA

BUY A LIFETIME SUB – And Help Build a Nuclear Power Plant

Here is a picture of Earl Carrier K8WLP, a Lifetime Subscriber to 73. He is employed by Ludtke Engineering Co., as an equipment operator on a dredge in Lake Erie. The dredge was installing a water inlet pipe at the Davis Besse Nuclear Power Plant being built near Port Clinton OH. While there Earl had clock number 73.

Earl Carrier K8WLP
Sandusky OH

NORWEGIAN LICENSE – ANYONE?

Re the article "Europe On 2m A day," which you published in the April 1973 issue of 73. I would like to add another country to that list – NORWAY.

If you are planning on visiting Norway and would like a reciprocal license write to: Norwegian Telecommunications Administration, Radio Inspection Office, P.O.B. 6701, St. Olavs Plass, Oslo 1, Norway. They will send a form and information in English. The cost is 50 NKr ($9). They require a letter of good conduct from your local police. The form states that it should be returned to them via the FCC. However, I got a letter (valid license with no violations) from the FCC and submitted it with the application and a photocopy of my license. The address is a P.O. Box, but the office is in the same building and in a pinch the license can be issued in person.

Dave Williams K7HMP
APO NY

BRAILLE PUBLICATION

There is now available for blind hams a Braille publication entitled "DX and the Blind Ham." This is a non-profit publication which will give the blind ham much information which was here-to-fore unavailable.

The 78-page book casts $2.84 (which includes handling and postage within the U.S.). International prefixes and locations, compass bearings from three locations in the U.S., distances from these locations and other useful information is given. If you are interested you can send a check or money order to: Peninsula Braille Transcribers Guild, c/o Roy Phelps WB6FIS, 166 Novato Dr., Vacaville CA 95688.

Roy Phelps WB6FIS
Vacaville CA

IRS TEMPORARY – HA! HA!

I have been following the articles in 73 about the IRS for the last few months. I would like to state that I am behind you in your views 100%.

I am led to understand that the Income Tax Bill was adopted as a temporary tax. Ha! Ha! Since that time this tax has turned out to be about as temporary as the Berlin Wall. Personally speaking I would not mind paying the tax quite as much if I could believe that the different income levels were doing their fare share. As it is now the poverty levels are all but exempt, and the wealthy people just hire a lawyer to evade taxation through various loopholes. This leaves the middle, or working class people at the mercy of the IRS.

As an example: My wife and I grossed just over $12,000 last year. We both had claimed 0 dependants on our W2 forms. At the end of the year our totaled deductions came to over $1,300. When we filed our return we claimed two dependants, which should have put us in the clear. We were informed by the IRS that we still owed them money. This taxation, of course, does not include my state sales tax of 5%.

In my opinion, with the rapidly rising cost of living and over-taxation, many Americans have attained a level where unemployment might be profitable. Why then could we not do away with the obsolete income tax program and replace it with a sales tax program? Under this program if you earned more, and spent more, you would pay more in taxes, whereas the reverse would be true in the lower income levels? Would this not be a more fair tax program?

Name Withheld
Dallas TX

IRS PRIVILEGED?

Be careful with whom you discuss your IRS problems. The courts have just recently ruled that any information your attorney may have about you in IRS matters is not privileged information. I have also had some problems with the IRS.

Name Withheld
Garden Grove CA

MORE IRS

Please continue to keep us informed via 73 on the IRS and its tactics of harrassment. 73 has brought forth some very interesting information on those "characters," and it sure is about time that someone opened the lid. I guess the tax collector hasn't changed very much from Biblical times. Perhaps if enough data is collected, you could publish a book on the subject. I would certainly purchase it if you did.

Keep up the good work, especially your articles on IC's and their applications. Good luck.

Name Withheld
Elyria OH

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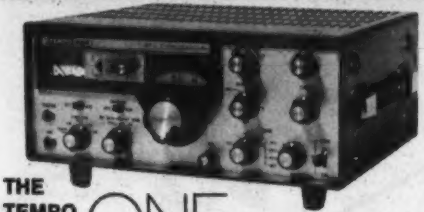
Now, when your dollar buys less and less . . . value received for your money becomes more and more important. In only three years Tempo has established a solid reputation for first rate performance at a reasonable price.



THE TEMPO ONE SSB TRANSCEIVER

Look at the specifications . . . look at the price tag . . . ask any of the thousands of Tempo ONE owners about its reliability . . . and the reason for its unparalleled popularity will be obvious. The Tempo ONE is now the proven ONE.

FREQUENCY RANGE: All amateur bands 80 through 10 meters, in five 500 khz, ranges: 3.5-4 mhz., 7-7.5 mhz., 14-14.5 mhz., 21-21.5 mhz., 28.5-29 mhz. (Crystals optionally available for ranges 28-28.5, 29-29.5, 29.5-30 mhz.)
SOLID STATE VFO: Very stable Colpitts circuit with transistor buffer provides linear tuning over the range 5-5.5 mhz. A passband filter at output is tuned to pass the 5-5.5 mhz. range.
RECEIVER OFFSET TUNING (CLARIFIER): Provides ±5 khz. variation of receiver tuning when switched ON.
DIAL CALIBRATION: Vernier scale marked with one kilohertz divisions. Main tuning dial calibrated 0-500 with 50 khz. points.
FREQUENCY STABILITY: Less than 100 cycles after warm-up, and less than 100 cycles for plus or minus 10% line voltage change.
MODES OF OPERATION: SSB upper and lower sideband, CW and AM.
INPUT POWER: 300 watts PEP, 240 watts CW
ANTENNA IMPEDANCE: 50-75 ohms
CARRIER SUPPRESSION: −40 dB or better
SIDEBAND SUPPRESSION: −50 dB at 1000 CPS
THIRD ORDER INTERMODULATION PRODUCTS: -30 dB (PEP)
AF BANDWIDTH: 300-2700 cps
RECEIVER SENSITIVITY: ½ µv input S/N 10 db
AGC: Fast attack slow decay for SSB and CW.
SELECTIVITY: 2.3 khz. (−6 dB), 4 khz. (−60 dB)
IMAGE REJECTION: More than 50 dB.
AUDIO OUTPUT: 1 watt at 10% distortion.
AUDIO OUTPUT IMPEDANCE: 8 ohms and 600 ohms
POWER SUPPLY: Separate AC or DC required. See AC "ONE" and DC1-A.
TUBES AND SEMICONDUCTORS: 16 tubes, 15 diodes, 7 transistors

TEMPO* "ONE" TRANSCEIVER	$349.00
AC/ONE POWER SUPPLY 117/230 volt 50/60 cycle	$ 99.00
DC/1-A POWER SUPPLY 12 volts DC	$120.00
VF-ONE EXTERNAL VFO	$109.00

THE TEMPO 2001 LINEAR AMPLIFIER

Small but powerful, reliable but inexpensive, this amplifier is another top value from Henry Radio. Using two 8874 grounded grid triodes from Eimac, the Tempo 2001 offers a full 2 KW PEP input for SSB operation in an unbelievably compact package (total volume is .8 cu. ft.). The 2001 has a built-in solid state power supply, a built-in antenna relay, and built-in quality to match much more expensive amplifiers. This equipment is totally compatible with the Tempo One as well as most other amateur transceivers. Completely wired and ready for operation, the 2001 includes an internal blower, a relative RF power indicator, and full amateur band coverage from 80-10 meters. PRICE: $545.00

YAESU

... a name proven through world-wide use. ... now available at Henry Radio. Come in, phone or write for complete specifications. We ship almost every where.

FT-101B	Transceiver	649.00
FTdx-401	Transceiver	599.00
FL-2100	Linear Amp with tubes	339.00
YC-355D	Digital Counter	289.00
FV-101	External VFO	99.00
SP-101P	Speaker/patch	59.00
SP-101	Speaker	19.00
FV-401	External VFO	99.00
SP-401P	Speaker/patch	59.00
SP-401	Speaker	19.00
YD-844	Dynamic microphone	29.00
XF-3C/30C	C.W. filter	40.00
FA-9	Fan	19.00
MMB-1	Mobile bracket	9.00

Prices subject to change without notice.

Henry Radio

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7407	.50	7453	.25	74141	1.25
7408	.30	7454	.25	74151	1.10
7409	.30	7473	.50	74153	1.40
7410	.25	7474	.50	74154	1.70
7411	.30	7475	1.00	74157	1.40
7413	.85	7476	.65	74164	2.00
7416	.50	7483	1.25	74165	2.00
7417	.50	7486	.50	74166	2.00
7420	.25	7489	3.25	74181	4.50
7430	.25	7490	1.00	74192	1.75
7432	.30	7492	1.00	74193	1.50
7437	.50	7493	.80	74195	1.15
7438	.50	7495	1.00	74200	9.00

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MAN3 $2.00 4/$6.00
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Man 4 $2.75 4/$8.00
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MISSING SEGMENT/NO DECIMAL POINT
(take your chances; no choice)
MAN3 $.25
MAN4 .50

DISCRETE RED LEDS	1–9		10+
MV10 TO-18	$.25		.20
MV50 tiny	.35		.30
MV5024 diffused	.35		.30
bright red lens		.50	
clear lens, fisheye		.50	
DISCRETE COLORED LEDS			
MV1 amber		.50	
MV5020 type, amber		.50	
MV2 TO-18 green	.75		.70
MV5222 green		1.00	
MV5322 yellow		2.00	

JUNCTION FETs, TO-18 case

N-CHANNEL:	SIMILAR TO:	
NJF10	2N4416, MPF102	3/$1.00
NJF11	2N4091-93	4/$1.00
NJF12	2N4338-41	4/$1.00
NJF13	2N3089	3/$1.00
NJF14	2N4221-22	4/$1.00
P-CHANNEL:		
PJF11	2N3382-86	4/$1.00
PJF14	2N2608	4/$1.00

All FETs come with data sheets.

TRANSISTORS

NPN TO-18 general purpose silicon	.15
10 or more,	.10
PNP TO-18 general purpose silicon	.15
10 or more,	.10
2N2222 (NPN) TO-18	.25
10 or more,	.20
2N2907 (PNP) TO-18	.25
10 or more,	.20

UNTESTED DTL

All marked units, dual in-line packages. 20/$1.00

POWER SUPPLY KIT PS 5-1

5 volt 1 amp regulated power supply kit with p.c. board and instructions. Board measures 2"x6"; completed kit is 2" high. Transformer has internal r.f. shield.

MARCH SPECIAL $8.00

WIRE WRAP SOCKETS

14 pin	$ .50
16 pin	.60
24 pin	1.25
28 pin	1.35
40 pin	1.80
wire-wrap socket pins	.05
100 or more,	.04

LEDS

LED 10R – Pack of 10 discrete red lens LEDs, various MV5020-series types. $1.50
LED 10C – Pack of 10 discrete clear lens LEDs, various MV5020-series types. $1.50
Application note included.

RECTIFIERS & DIODES

1amp 50PIV silicon rectifier		$ .10
3amp 400PIV silicon rectifier		.25
FB50 1amp 50PIV bridge rectifier		.60
40429 triac 4amp 200PIV, brand new		1.00
	1-99	100+
1N914,	.10	.07 ea.

MEMORIES

MM1101	256-bit static RAM	$2.25
MM5260	1024-bit dynamic RAM	8.00

¼ WATT RESISTORS

all values listed are $.05; 10 or more, .04
We have: 150Ω, 2.2K, 2.7K, 10K, 12K, 18K, 47K, 220K
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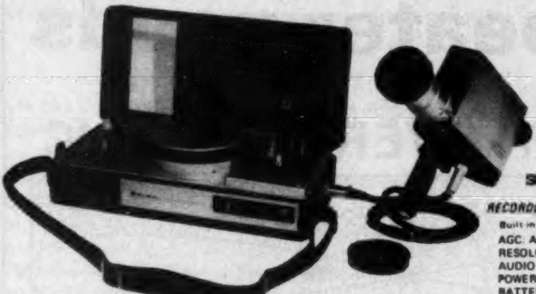
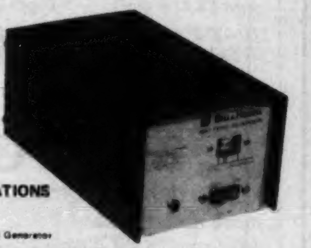
VIDEO TAPE RECORDERS





SPECIFICATIONS

RECORDER:
Built in 2:1 EIA Sync Generator
AGC: Audio & Video
RESOLUTION: 525 lines, HOR. RESOLUTION: 300 lines
AUDIO RESPONSE: 80-10,000 Hz
POWER REQUIREMENTS: 12V DC, 10 watts
BATTERIES: 2/3G x 3/U Rechargeable (not included)
CHARGER: Model 105805 included

CAMERA:
RESOLUTION: 525 lines HOR. RESOLUTION: 500 lines
VERT. FREQ: 60 Hz (EIA)
HOR. FREQ: 15,750 Hz (EIA)
VIDEO OUTPUT: 1.0 p-p, 75 ohm, unbalanced
MIN. ILLUMINATION: 30 lux.
VIEWFINDER: 1½" (1" CRT w/magnifier)
LENS: 5:1 zoom F2 – 22
SHIPPING WT. 35 lbs.

BELL & HOWELL MODEL 2965
(Records Only)

This is a portable video system and comes with battery operated recorder, camera and chargers. A TV monitor is built into the camera as a viewfinder. Camera includes built-in microphone and zoom lens. Recording time is 20 minutes on 4½" reel (800'). Recording is both audio and video.

LIST: $1595
OUR PRICE (NEW) **$550.00**

RECHARGEABLE BATTERIES – New, for Porta Pak. $36.00 a set.

COLOR ADAPTERS – limited number available, will work with almost any Black and White VTR to convert to NTSC color, record-playback does not impair monochrome use. $450.00 ea. prepaid.

NEW NAME BRAND VIDEO TAPES – 2400 ft. (1 hr.) any quantity available, shipping wt. 2 lbs. $29.00 each.
1200 ft. (½ hr.) $19.00 each.

CONDITIONS OF SALE:
NEW EQUIPMENT – sold new, as is.

USED EQUIPMENT – sold as is in good working order. NO warranty. All units checked prior to shipment.

BELL & HOWELL Model 2966

This video recorder can record directly from a TV set or a TV camera. Audio may be dubbed onto the tape. A 7" reel (2400') will record 1 hr. No home VTR unit under $1000 can match the quality and capabilities of this unit.

SPECIFICATIONS
RESOLUTION: 525 lines, Standard TV or CCTV recording
VIDEO: Input and output: 1.0V p-p, 75 ohms, unbalanced. Greater than 3.0 MHz freq. response. 300 lines plus Hor. resolution
AUDIO: Mike or line inputs. 60-10,000 Hz freq. range
POWER REQUIRMENTS: 110V AC, 95 watts
DIMENSIONS: 18 3/8" W. x 10 3/16" H. x 15 11/16 D.
WEIGHT: 60 lbs.

LIST PRICE (1972) $995.00
OUR PRICE *NEW* $450.00
USED $250.00

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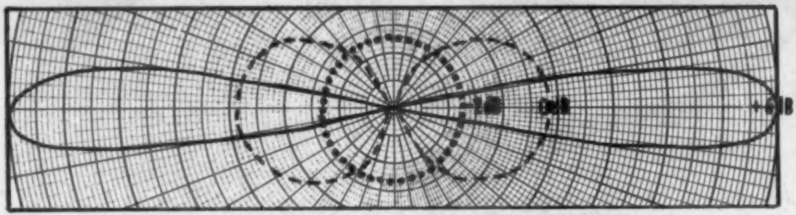
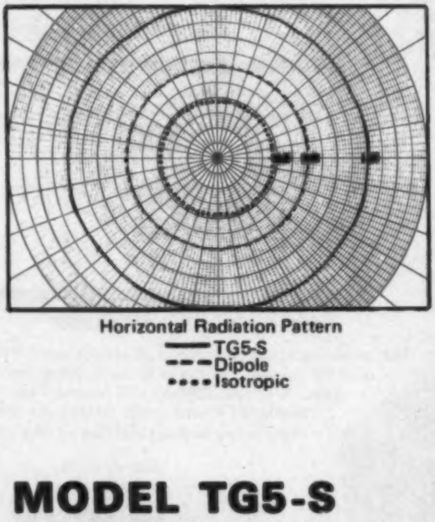
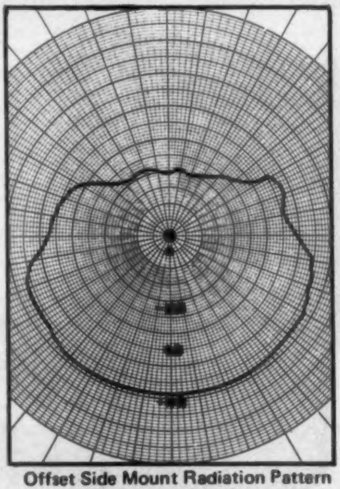


Vertical Radiation Pattern
—— TG5-S
--- Dipole
•••• Isotropic



Horizontal Radiation Pattern
—— TG5-S
--- Dipole
•••• Isotropic



Offset Side Mount Radiation Pattern
Reference: Dipole

MODEL TG5-S

104^{50} LIST PRICE

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LED READOUTS OPCOA SLA-1 Similar to MAN-1. .33" high. 20 mA per segment. With decimal point. Every one checked — all segments operating. **Red — $2.65 each, 6/$15.00**
Green — $3.50
Big Readouts, .7" high. Red . . . $5.55 each

CLOCK I.C., National MM5314, for 12 or 24 hours, 50 or 60 Hz, 4 or 6 digits. **Only $11.95 each**

LED — molded plastic dome shape with leads. .312 inches in diameter. **Red — $.35 each, 3/$1.00**
Green — $.50 each, 6/$2.50

LM 309 Voltage Regulator IC. 5 volts at 1 Amp. max. current. **$2.00 each**

PRINTED CIRCUIT BOARD 2 oz. copper on glass epoxy base, approx. 5" x 6". Your choice copper on one or both sides. **3/$1.25**

ETCHANT FOR P.C. BOARDS Ammonium persulfate, 1 lb. of crystals, just dissolve in H_2O. **$1.25**

IN 914 DIODES **$.10 each, $1.00 a dozen**

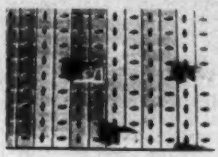
PLUG-INS for Tektronix scopes: $40.00 each. Type A, Wide-band; D, High-gain DC differential, 1 mv./cm. (Hickok); E, High-gain AC Differential; G, Wide-band Differential; K, Fast-rise; Type P, Fast-rise Mercury pulser test unit **$25.00**

HUGHES WB-4 Preamplifier Plug-in **$25.00**

PLUG-INS for H-P 524 Counters. 526-A Video Amplifier, $40.00; 526-B Time Interval Unit. **$25.00**

FILAMENT TRANSFORMER, 6.3 v. ct. @25 amps., 115/230 v. 60 Hz pri. Herm sealed. Shpg. wt. 14 lbs. **$4.00 each,4/$14.00**

SILICON RECTIFIER International Rect. R–210–F, epoxy, 1000 PIV, 2 amps. **$.40 each, 10/$3.50**



Matrix Plug-Board. Wired in 25 horizontal & 24 vertical rows. By inserting jumper plugs, any hor. row can be connected to any vert. row. Constructed of Elco "Varicons." Can be disassembled or rewired for other applications. Great for breadboarding, switching, programming, I.C. testing. Dimensions: 8¾" x 16¾". Shpg. wt. 8 lbs. Used, exc. cond. with 30 shorting plugs. **Only $10.00**

Matrix Board with 25 x 12 rows. (Half of above board.) With 15 plugs. **$5.50**

Teletype Model 28 Tape Equipment. Tape reader LBXD & Perforator BRPE on LRXB9 Base, mounted on LTHS Tape Handling Unit. Reader is 60–75–100 wpm. Perforator is high-speed (600 wpm). Exc. Cond., as removed from service. Shpg. wt. 100 lbs. **$75.00 each**

H-P 5221-A Digital Counter, Solid-State, 10 MHz. Like new. **$150.00**
Empire Devices (Singer) NF-105 Receiver with T-2, T-3, T-A Tuners, Exc. Cond. **$1800.00**
Stoddart NM-20B Radio Interference & Field Intensity Receiver, with power supply, loop antennas, cables. Exc. Cond. **$385.00**

P.C. Board Edge Sockets. Amphenol. 3/16" contact spacing. 6-contacts, with solder terminals. **25¢**
15-contacts, with wire-wrap terminals, used, exc. **25¢ ea, 5 for $1.00**

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7402	.35	7474	.55
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7408	.35	7476	.65
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7448	1.65	74192	1.90
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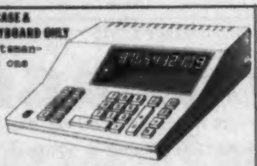

Attractively designed! Excellent craftsmanship. Case and keyboard (designed as one unit). Cabinet is made of high-impact plastic beige color with black bezel and amber window. Keyboard consists of a 3-position slide switch and 25 keys, 5 of which are used for memory function. 20 keys grey, 5 keys orange. All keys mounted on one printed circuit board. This modular unit is well suited for our calculator chips. Ideal for the CT5005. Case and Keyboard Complete: ONLY $29.95

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SPECIAL: 5 FOR $20.00

3-CHIP CALCULATOR

This calculator set provides all of the electronics for an 8-digit, floating point calculator with left-hand entry. Keyboard, display, clock generator, and display driver is all that need be added to make a calculator that will add, subtract, multiply and divide. Overflow and negative signals are also provided. Complete instructions to build a calculator included.

CHIPS AND DATA............$8.95
DATA ONLY (Refundable).... 1.00

CT5005 CALCULATOR

This calculator chip has a full four-function memory, which is controlled by four keys, +M (adds entry into memory), -M (subtracts entry from memory), CM (clear memory, without clearing rest of registers), RM (read memory or use as entry).

12-Digit display and calculate
Fixed decimal at 0, 1, 2, 3, 4, or 5
Leading zero suppression
7-Segment multiplexed output
True credit sign display
Single 28-pin chip

CHIP AND DATA...........ONLY $9.95
DATA ONLY (Refundable)....... 1.00

5001 CALCULATOR

40-Pin calculator chip will add, subtract, multiply, and divide. 12-Digit display and calculate. Chain calculations. True credit balance sign output. Automatic over-flow indication. Fixed decimal point at 1, 2, 3, or 4. Leading zero suppression. Complete data supplied with chip.

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DATA ONLY (Refundable).... 1.00

All ICs are new and fully-tested; leads are plated with gold or solder. Orders for $5 or more will be shipped prepaid. Add 35¢ for handling and postage for smaller orders; residents of California add sales tax. IC orders are shipped within 2 workdays—kits are shipped within 10 days of receipt of order. $10.00 minimum on C.O.D.s (phone in).

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MV50 red emitting 10-4 ma @ 2V	$ .25 5 FOR 1.00

MV5024 red TO-18 high dome	$ .75 10 FOR 6.50

MV10B visible red 5-7 ma @ 2V	$ .30 10 FOR 2.50

SPECIAL 874

256-BIT RANDOM ACCESS MEMORY

TTL bi-polar fully-decoded 256 x 1 bit:

- Single 5V supply
- 80 NS access time
- Simple memory expansion thru 3-chip select lines

Data with chip. $5.00

16-Pin DIP. 10 FOR $39.95

3-Amp Power Silicon Rectifiers Marked Epoxy Axial Package

PRV	PRICE	PRV	PRICE
100.....	$ .10	800.....	$ .30
200.....	.15	1000....	.40
400.....	.18	1200....	.50
600.....	.23	1500....	.65

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CD4001	$ .75	CD4023	$ .75
CD4002	.75	74C00	.75
CD4010	1.00	74C20	.75
CD4011	.75	74C160	3.25
CD4012	.75		

7400 Series DIP

7400	$ .25	74LS1	$ .30
74H00	.35	74H51	.35
7401	.25	7453	.20
7402	.35	7454	.25
74H01	.35	74L54	.35
7403	.30	74L55	.35
7404	.28	7460	.20
74H04	.35	74L71	.30
7405	.28	7472	.40
7406	.70	74L72	.50
74H05	.35	7473	.60
7408	.35	74L73	.75
74H08	.35	7474	.65
7410	.25	74L74	.80
74L10	.35	74H74	.80
74H11	.35	7475	1.40
7413	1.25	7476	.60
7417	.40	74L78	.80
7420	.25	7480	.65
74L20	.35	7483	1.00
74H20	.35	7489	4.00
74H22	.35	7490	1.20
7430	.25	7491	1.00
74H30	.35	7492	.90
74L30	.40	7493	1.15
7440	.25	7494	1.15
74H40	.35	7495	1.15
7441	1.25	74L95	2.00
7442	1.20	74121	1.25
7446	1.20	74123	1.50
7447	1.20	74154	2.30
7448	1.00	74161	2.00
7450	.25	74163	2.00
74H50	.35	74193	1.50
7451	.25	74195	1.00

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VARO FULL-WAVE BRIDGES

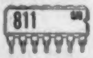
V5447	2A	400V		$ .90
V5647	2A	600V		1.10
MR810 Rect.	50V	1A		.10

Special 811: Hex Inverter

TTL DIP Hex Inverter; pin interchangeable with SN 7404. Parts are brand new and are branded Signetics and marked "811."

Data Sheet Supplied

EACH.......$	.30
10 FOR.....	2.50
100 FOR....	23.00
1000 FOR...	220.00



MAN 3M

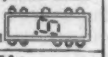
0-9 plus letters. Right-hand decimal point. Flat-pack type case. Long operating life. IC voltage requirements. Ideal for pocket calculators!

EACH	$2.50
10 OR MORE	1.90
W/O DECIMAL	1.50

MAN4

Seven-segment, 0-9 plus letters. Right-hand decimal point. Snaps in 14-pin DIP socket or Molex. IC voltage requirements. Ideal for desk or pocket calculators!

EACH.......$2.75
TEN OR MORE 2.50 EACH



CD-2 Counter Kit

This kit provides a highly sophisticated display section module for clocks, counters, or other numerical display needs. The unit is .8" wide and 4 3/8" long. A single 5-volt power source powers both the ICs and the display tube. It can attain typical count rates of up to 30 MHz and also has a lamp test, causing all 7 segments to light. Kit includes a 2-sided (with plated thru holes) fiberglass printed circuit board, a 7490, a 7475, a 7447, a DR 2010 RCA Numitron display tube, complete instructions, and enough Molex pins for the ICs . . NOTE: boards can be supplied in a single panel of up to 10 digits (with all interconnects); therefore, when ordering, please specify whether you want them in single panels or in one multiple digit board. Not specifying will result in shipping delay.

COMPLETE KIT,
ONLY $11.95
FULLY-ASSEMBLED
UNIT $13.00

Boards can be supplied separately @ $2.00 per digit.

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NE561	phase lock loop DIP..............	3.25
NE565	phase lock loop TO-5.............	3.25
NE566	function generator TO-5.........	4.00
NE567	tone decoder.....................	4.00
NE5558	dual 741 op amp MINI DIP........	1.00
709	popular op amp DIP..............	.45
710	voltage comparator DIP..........	.75
711	dual comparator DIP.............	.40
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741	op amp TO-5/MINI DIP............	.55
747	dual 741 op amp DIP.............	1.00
748	op amp TO-5.....................	1.00
CA3018	2 isolated transistors and a Darlington-connected transistor pair	1.00
CA3045	5 NPN transistor array..........	1.00
CA3026	dual differential amp...........	1.00
LM100	positive DC regulator TO-5......	1.00
LM105	voltage regulator...............	1.25
LM302	op amp voltage follower TO-5....	1.25
LM307	op amp..........................	.50
LM308	op amp TO-5.....................	2.00
LM311	comparator TO-5.................	1.75
LM370	AGC amplifier...................	2.00
LM703	RF-IF amp epoxy TO-5............	.45
LM309K	5V-1A power supply module TO-3..	2.00
LM3900	quad op amp.....................	2.00
LM1595	4-quadrant multiplier...........	2.00
8038	sine square triangle function generator........	4.95

Before you buy... take time to compare

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. . . spec for spec . . .
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5. 1/10 watt switch power saving option.
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9. Trimmer caps on both trans. and rcv. on all 22 channels . . . with a discriminator output jack in the back to let you get on and stay on freq.
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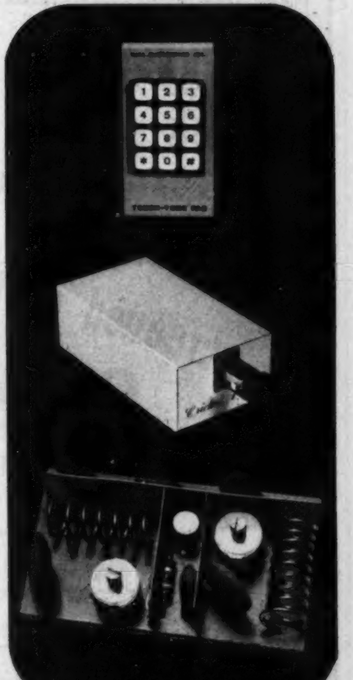

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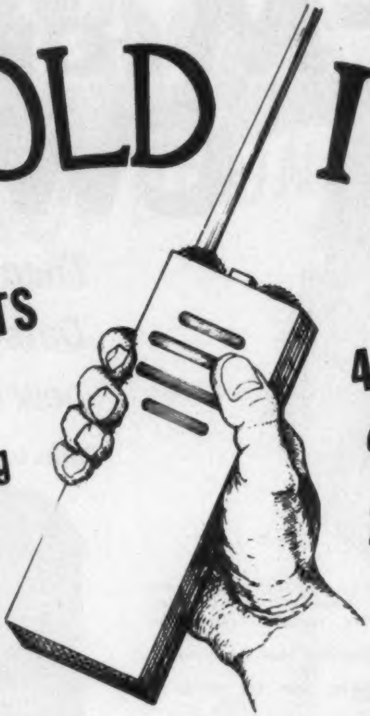

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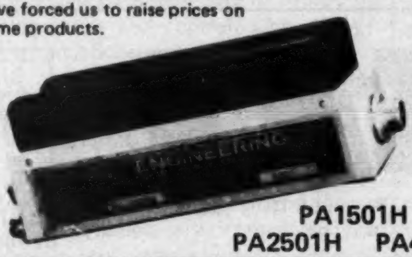
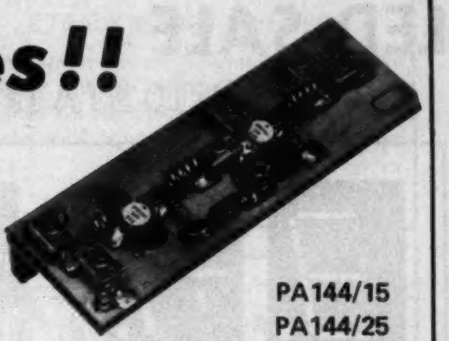


PA1501H
PA2501H PA4010H



PA144/15
PA144/25
PA220/15

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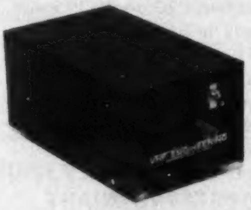
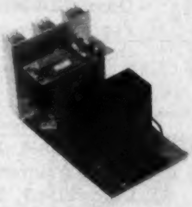
PA-4010-H	5-12	40	$59.95	$74.95
PA-110/30	15-40	110	N.A.	$149.95
PA-110/10	3-12	110	N.A.	$179.95
PA-144/15	1/2-1	15	$39.95	NOTE: Less case and switching.
PA-144/25	1-4	25	$49.95	
PA-220/15	1/2-1	15	$39.95	





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50 MV Ripple Max.
Adjustable 11-15 VDC

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SHIPPING WEIGHT 12 lb.

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LED SALE LED SALE

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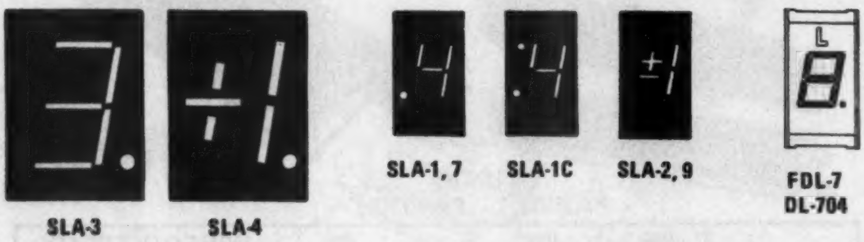

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11-48704	Pkg. of 8 current limiting resistors for DL-704	.36
86-00007	Litronix FDL-7, .31" high, 7-Segment LED display	2.00
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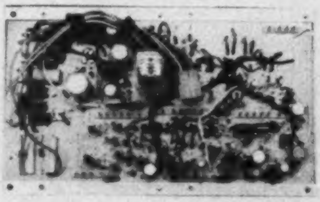
PK–4 $7.50



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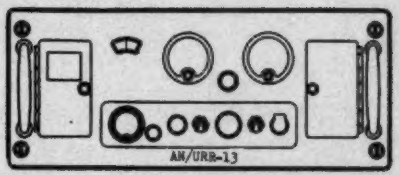

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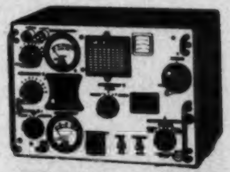

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☐	SN7425	.50
☐	SN7426	.36
☐	SN7430	.30
☐	SN7432	.35
☐	SN7437	.55
☐	SN7438	.55
☐	SN7440	.30
☐	SN7441	1.40
☐	SN7442	1.50
☐	SN7443	1.50
☐	SN7444	1.50
☐	SN7445	1.50
☐	SN7446	1.65
☐	SN7447	1.45
☐	SN7448	1.50
☐	SN7450	.30
☐	SN7451	.30
☐	SN7453	.30
☐	SN7454	.30
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☐	SN7462	.35
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☐	SN74145	1.55
☐	SN74148	4.50
☐	SN74150	1.61
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☐	SN74155	1.55
☐	SN74156	1.45
☐	SN74157	1.55
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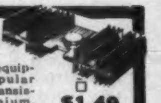

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☐	75491	Quad seg driver for LED readouts	1.65
☐	75492	Hex driver w/cel. out 250 ma. For LED readouts	1.85

(A) TO-5 or DIP dual in line pak

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	Type	LED	Charac.	Sale
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☐	KR-103	MAN-4	.19	47.
☐	KR-104	Nixie*	.45	47.
☐	KR-105	707†	.33	47.
☐	KR-106	704†	.33	47.
☐	KR-107	SLA-1†	.33	47.
☐	KR-100	Same as SLA-1 but GREEN, add $12.		

† "MAN" LED readouts are "all LEDs" but the Litronix 707 and Opcoa SLA-1, like the MAN-1, are of the reflective bar segment technique, the 704 is the reflective bar version of the MAN-4. *The Nixie tube is a 7-segment device as others.

- Now two clocks in one!
- For 12VDC* 110VAC!
- Now adaptable to boats, planes & cars too!
- One price for any LED!
- The only clock of its kind in USA today!
- Compare and see!
- 12 or 24-hr clock

Scientific Devices introduces the new any LED Kronos digital clock. That's right, you can choose the "ALL-LED" Man-1, Man-3, and Man-4, and the new reflective bar types with the larger digits, at only one price, $47. This is a Scientific Device first! We even hav the GREEN LED readouts at a slightly extra cost. We have more . . . for $19.95 we have available as an (*) extra option to Naval Observatory your clock, or making it an all-purpose all-duty unit. For indoor and outdoor activity. This "TIME BASE" is the simplest on the market today with the help of one of the largest time base manufacturers for the famous digital wrist watches. Therefore, current drain is negligible, not like other cumbersome types. It's easy to construct, easy to slip into the Kronos of your choice and connect with easy instructions. Its overall design is simple and easy to construct. The kit is complete with famous black-and-white TEN-TEC cabinet, plus all accessories with booklets. Features include 3 setting controls, 1-hour per second, 1-minute per second, and hold button. KR100 series is a Scientific Device exclusive!

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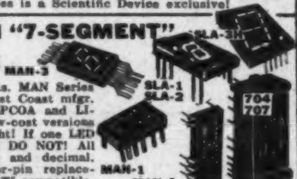
LITRONIX-OPCOA-MAN "7-SEGMENT" LED Readouts



All fit 14-pin IC sockets. All 7-segments. MAN Series "all LED" and made by well-known West Coast mfgr. Others Reflective Bar type made by OPCOA and LITRONIX. The Reflective Bar types are low-cost versions of the MAN's except .33 character height! If one LED blows you lose a segment. MAN's you DO NOT! All readouts 0-to-9 numerals, plus letters and decimal. **Opcoa and Litronix products pin-for-pin replacements for MAN-1 MAN-4. All 5V TTL compatible.

ALL LED READOUTS — TYPE	character Size	Color Display	Decimal	Mils	Driver	Each	Special
☐ MAN-3 equal	.115	Red	Yes	10	SN7448	1.69	3 for 4.50
☐ MAN-3 equal	.115	Red	***	10	SN7448	1.50	3 for $4.
☐ MAN-3M equal*	.127	Red	Yes***	10	SN7448	1.50	3 for $4.
☑ MAN-4 equal*	.190	Red	Yes	15	SN7448	2.50	3 for $6.
☐ MAN-4 equal*	.190	Red	Yes***	15	SN7448	2.25	3 for $5.
"REFLECTIVE LITE BAR" (Segment LED Readouts)							
☐ 707** (MAN-1)	.33	Red	Yes	20	SN7447	2.75	3 for $6.
☐ 704** (MAN-4)	.33	Red	Yes	20	SN7448	2.75	3 for $6.
☐ SLA-1** (MAN-1)	.33	Red	Yes	20	SN7447	2.75	3 for $6.
☐ SLA-1** (MAN-1)	.33	Red	No	20	SN7447	2.25	3 for $5.
☐ SLA-3H Giant	.70	Red	Yes	20	SN7447	6.50	3 for $18.
☐ SLA-11C** (MAN-5	.33	Green	Yes	40	SN7447	4.95	3 for $13.

* Red epoxy case, others clear. ** Litronix and Opcoa's pin-for-pin equals and electrical specs as MAN-1 or MAN-4. *** LED "dot" missing

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* Pin-for-pin MAN-1, ** Pin-for-pin MAN-4, elec. char. same

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READOUT	Char.	Maker
☐ MAN-1	.27 h.	Monsanto
☑ MAN-4	.19 h.	Monsanto
☐ 707*	.33 h.	Litronics
☐ 704**	.33 h.	Litronics
☐ SLA-1*	.33 h.	Opcoa

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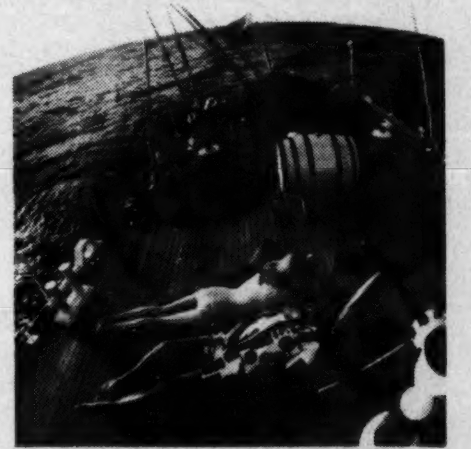

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GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7	7	7	7	7	7	7	7	14	14	14
ARGENTINA	14	14	7A	7	7	7	14	21	21	21	21	21
AUSTRALIA	14A	14	7B	7B	7B	7	7	14	14	14	14	14A
CANAL ZONE	14	7A	7	7	7	7	14	14A	21	21	21	21
ENGLAND	7	7	7	7	7	7B	14	14A	14A	14A	14	7B
HAWAII	14	14	7B	7	7	7	7	7B	14	14	14A	14A
INDIA	7	7	7B	7B	7B	7B	14	14	14	7	7	7
JAPAN	14	7B	7B	7B	7B	7	7	7	7	7B	7B	14
MEXICO	14	7	7	7	7	7	7	14	14	14	14A	14A
PHILIPPINES	14	7B	7B	7B	7B	7B	7B	14	14	14	7B	14B
PUERTO RICO	14	7	7	7	7	7	7A	14	14	14	14	14
SOUTH AFRICA	14	7	7	7	7B	14	14	21	21	21	14	14
U. S. S. R.	7	7	7	7	7	7B	14	14	14	14	7B	7
WEST COAST	14	14	7	7	7	7	7	14	14	14	14A	14A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	7	14	14	14
ARGENTINA	14	14	7	7	7	7	7A	21	21	21	21	21
AUSTRALIA	21	14	14	7B	7B	7	7	7	14	14	14	21
CANAL ZONE	14A	14	7	7	7	7	7	14	21	21	21	21
ENGLAND	7	7	7	7	7	7	7B	14	14	14	14	7B
HAWAII	21	14	14	7	7	7	7	7	14	14	21	21
INDIA	7	7	7B	7B	7B	7B	7B	7B	14	7A	7	7
JAPAN	14	14	7B	7B	7B	7	7	7	7	7B	7B	14
MEXICO	14	7	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	7B	7B	7B	7B	7B	7	14	14	7B	14
PUERTO RICO	14	7A	7	7	7	7	7A	14	14	14A	14A	14A
SOUTH AFRICA	14	7	7	7	7B	7B	14	14	14A	14A	14	14
U. S. S. R.	7	7	7	7	7	7	7B	7B	14	14	7B	7

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7A	7	7	7	7	7	7	14	14	14
ARGENTINA	14	14	14	7B	7	7	7B	14	14	14A	21	21
AUSTRALIA	21	21	14	14	7B	7B	7	7	14	14	14	21
CANAL ZONE	21	14	7	7	7	7	7	14	21	21	21	21
ENGLAND	7	7	7	7	7	7	7B	7B	14	14	14	7B
HAWAII	21A	21A	14	14	7	7	7	7	14	14A	21	21
INDIA	7	14	14	7B	7B	7B	7B	7B	7A	7A	7	7
JAPAN	14A	14A	14	7B	7	7	7	7	7	7B	14	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14A	14A
PHILIPPINES	14A	14	14	7B	7B	7B	7B	7	7	14	7B	14
PUERTO RICO	14	14	7	7	7	7	7	14	14A	21	21	14A
SOUTH AFRICA	14	7B	7	7	7B	7B	7B	14	14	14A	14	14
U. S. S. R.	7	7	7	7	7	7	7B	7B	14	14	7B	7
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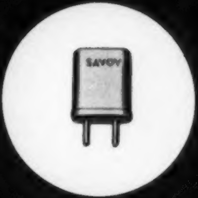

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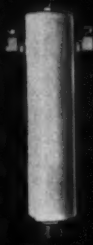

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